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CONTENTS.

PAGE

Thorium—A New Agent for Pyelography. (Illustrated.)
By J. Edward Burns, M. D. 157

A Statistical Study of 635 Labors with the Occiput Posterior.
By E. D. Plass, A. B., M. D. 164

A Letter of Edward Jenner Containing a Brief Account of His Discovery of Vaccination. (Illustrated.)
By Charles M. McBryde, M. D. 177

A Report of Sixty-Four Cases of Epilepsy in Patients from Fourteen Years to Forty Years of Age.
By L. R. Waters 179

Severe Anemia with Eosinophilia.
By Arthur F. Beifeld, M. D., and Milford E. Barnes, M. D. 181

The Possible Rôle of Books in the Dissemination of the Contagious Diseases.
By C. A. Laubach, M. D. 183

PAGE

Proceedings of Societies.

The Johns Hopkins Hospital Medical Society. 186
Presentation of a Possible Case of Heat Cramps [R. L. Haden];—The Diagnosis and Treatment of Umbilical Concretions, with Report of a Case [Dr. S. V. Irwin];—Medical Aspects of the European War. (Abstract.) [Dr. A. M. Fauntleroy, U. S. N.];—Wound Infection and Treatment. (Abstract.) [Dr. Kenneth Taylor];—Nerve Conduction in the Non-Medullated Nerves of Medusa Cassiopea. (Abstract.) [Alfred Goldsborough Mayer];—A System for Following Postoperative Patients [Dr. Frederick W. Bancroft];—Thorium—A New Agent for Pyelography [Dr. J. Edward Burns].

The Johns Hopkins Hospital Historical Club 190
Medicine in Japan and China [Dr. William H. Welch].

The Laennec 190
Tuberculosis in Early Childhood. (Abstract.) [Dr. Alma Rothholtz];—Carcinoma of Pleura [Dr. Stanhope Bayne-Jones];—Choroidal Tubercles in General Miliary Tuberculosis [Dr. R. L. Randolph and Dr. A. C. Schmeisser].

Books Received 191

THORIUM—A NEW AGENT FOR PYELOGRAPHY.[1]

By J. Edward Burns, M. D.,

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Ever since the introduction of pyelography by Voelker and Von Lichtenberg[2] in 1906, its prime importance in the rôle of renal diagnosis has readily been recognized. Although various attempts have been made to replace collargol, the medium recommended by them for injection, it has proven the pyelographic agent par excellence up to the present time. The various colloidal solutions of salts of heavy metals, which have been tried as substitutes, are those of silver, iron, bismuth, copper, lead and mercury, as have suspensions of the salts of bismuth, calcium and magnesium. All of these solutions sediment on standing, and while being for the most part quite opaque to the Roentgen ray, are viscous; moreover, a great many are quite toxic and irritating.

The chief objection to collargol is its irritant action when it escapes into the tissues, and, as a matter of fact, there have been a number of deaths reported following its use. Its elimination from the urinary tract is somewhat prolonged on account of its viscosity. The fact that it stains everything with which it comes in contact makes it objectionable. It is also quite expensive; for this reason its use for cystograms and large hydronephroses is often prohibitive.

An ideal solution for use in pyelography should be non-toxic, (within the ordinary limits of usage) non-irritating, quite opaque to the Roentgen ray, and give not only a good shadow but one of clear delineation; it should possess a marked degree of fluidity, permitting its ready escape from the urinary tract, and be inexpensive so as to be generally used.

Since the opacity of a substance to the Roentgen ray depends upon its atomic weight, thorium, being next to the heaviest known element, was quite ideal theoretically and seemed worthy of careful investigation.

The nitrate and chloride of thorium are quite readily soluble in water, giving a clear, markedly acid and astringent solution. These solutions precipitate insoluble salts in the urine and also precipitate proteins, this latter characteristic making impossible their intravenous introduction in greater degrees of concentration than two per cent. These solutions are also quite irritating. All of these qualities render them unfit for clinical

[1] A Preliminary Report on "Thorium—A New Agent for Pyelography" was published in the J. A. M. A., Vol. LXIV, pp. 2126-2127. This paper was read before The Johns Hopkins Medical Society, Feb. 21, 1916. From the James Buchanan Brady Urological Institute.

[2] Voelker & Von Lichtenberg; "Pyelographie (Röntgenographie des Nierenbeckens nach Kollargolfüllung" Münch. med. Wchnschr., 1906, LIII, 105-107.

use. However, on account of the ready solubility of these salts, a very concentrated solution can be made, the nitrate having been used in as high concentration as fifty per cent (Fig. 1). These solutions are particularly valuable for the injection of pathological specimens, the finest hair-line vessels and ducts being readily seen in the roentgenograms of these specimens. The plate below (Fig. 2) shows the seminal vesicles, ampullæ and vasa deferentia, injected with a fifteen per cent solution of thorium nitrate. After this injection the specimen was fixed in Kaiserling's solution, which latter caused a precipitation of thorium salts in the walls of the ducts, markedly accentuating their outline in the roentgenogram.

Regardless of the fact that the above mentioned properties render these salts unsuitable for clinical use, it is quite evident that thorium in some form would be ideal for use in pyelography. It is very well known, however, that different salts of the same metal vary greatly in their irritating and toxic action, these latter characteristics seemingly varying indirectly with the size of the molecule, and being sometimes especially reduced in a complex ion formation. After a careful series of chemical studies of the various combinations into which thorium may

FIG. 1.—Renal pelvis and ureter of rabbit injected with a 50 per cent solution of thorium nitrate.

enter, a solution containing a double citrate of sodium and thorium, together with an excess of sodium citrate and some sodium nitrate, was found to possess the qualities enumerated above as being necessary for an ideal pyelographic medium. The solutions used contain ten per cent and fifteen per cent of thorium nitrate, and are made in the following way:

To make 100 cc. of a ten per cent solution, 10 gm. of thorium nitrate are dissolved in as little distilled water as possible; to this solution, kept hot on a water or steam bath, are added 30 cc. of a fifty per cent solution of sodium citrate, the additions being made in small quantities, and care being taken to shake the solution thoroughly after each addition. At first, after the addition of the citrate solution, a white gummy precipitate is formed, which later becomes granular, and finally dissolves on the addition of all the citrate solution. This solution is then made neutral to litmus by the careful addition of a normal solution of sodium hydroxid, and made up to the required volume of 100 cc. with distilled water. On filtration, a clear, limpid solution is obtained, which, when sterilized, either by boiling or steam under pressure, is ready for use. The stability of the solution is not affected in the least by sterilization.

The chemical reactions involved in the preparation of this solution are probably as follows:

$$Th(NO_3)_4 + H_2O = HNO_3 + TH(NO_3)_3OH.$$

$$HNO_3 + TH(NO_3)_2OH + \begin{matrix} H_2 \\ | \\ C-CO_2Na \\ | \\ HO-C-CO_2Na \\ | \\ C-CO_2Na \\ | \\ H_2 \end{matrix} + NaOH =$$

Four possibilities:

$Th(NO_3)_3.O.C_6H_4O_7Na_3 + C_6H_5O_7Na_2 + Na\,NO_2 + H_2O.$
$Th(NO_3)_2(O.C_6H_4O_7Na_3)_2$
$Th(NO_3)(O.C_6H_4O_7Na_3)_3$
$Th(O.C_6H_4O_7Na_3)_4$

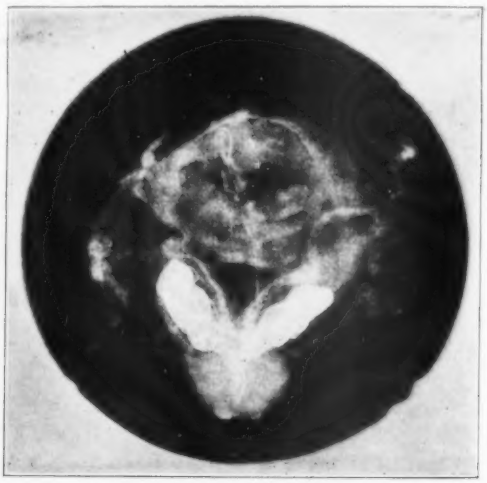
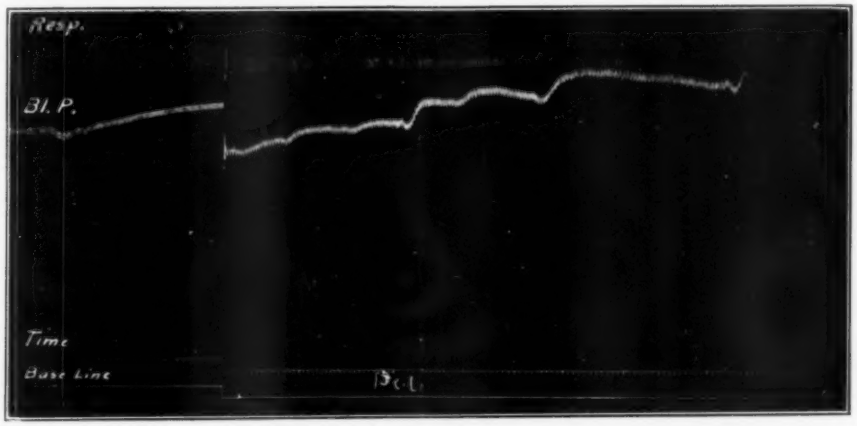


FIG. 2.—From a series of vesiculograms by Dr. E. M. Watson, Assistant Resident Urologist, James Buchanan Brady Urological Institute.

This solution contains approximately fifteen per cent of thorium nitrate, about nine per cent of sodium nitrate, and twenty-one per cent of sodium citrate, the thorium being most probably in the form of a double citrate of sodium and thorium, as shown above.

As the thorium content of the solution alone is responsible for its shadow-casting properties, its percentage strength has to be greater on account of the large size of the molecule of this double citrate than if the solution contained thorium nitrate alone, in which the molecules are much smaller and in consequence the atomic concentration much greater. The outline of the renal pelvis and ureter, as given by the shadow cast by this solution, is not only quite definite, but the shadow itself is of remarkably clear delineation.



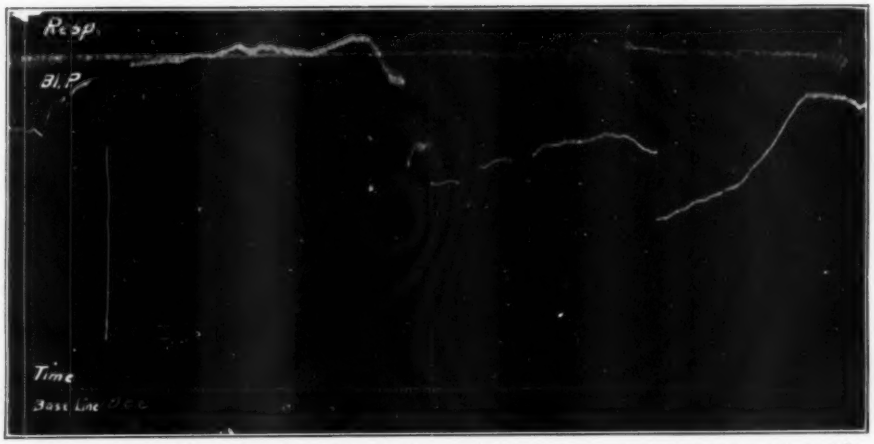


FIG. 3.—Kymographic tracings (Dog IX), showing rise in blood pressure, increase in pulse rate and decrease in respiration, after intravenous injection of 15 per cent thorium solution in small amounts—10 cc. The increase in magnitude of the respiratory waves in two places toward the end of the tracings is due to muscular twitching.

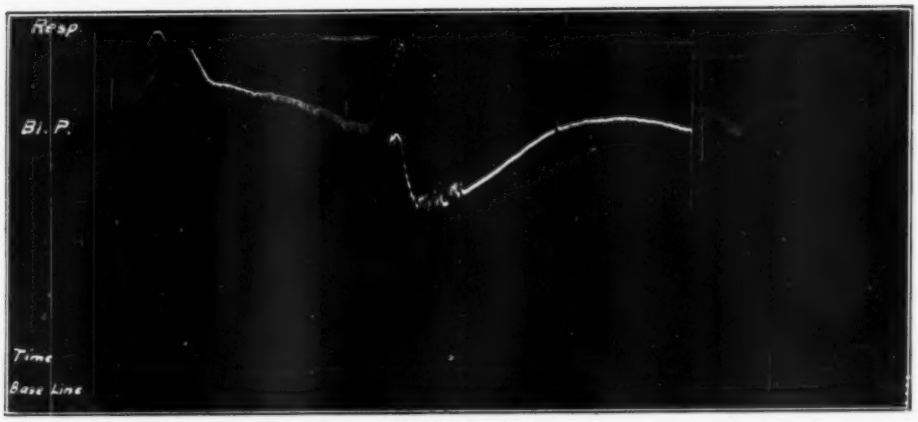


FIG. 4.—Kymographic tracings (Dog XIX), showing rise in blood pressure, increase in pulse rate, decrease in respiration, and periods of apnœa, after small injections of 10 cc., or less, of 15 per cent thorium solution intravenously, both vagi having been cut before the injection was begun.

In addition to its great opacity to the X-ray, the solution, either by its adhesive properties, by its capability of being absorbed by calculi, or by means of its comparative density, accentuates the shadows of calculi in the urinary tract when they are not ordinarily seen in plain Roentgen ray plates.

The marked degree of fluidity of the solution is of great advantage, for it so rapidly escapes from the kidney pelvis, ureter and bladder, that a plate, made a few minutes after the injection has been discontinued, gives no suggestion of a shadow, thus showing that the solution has been completely eliminated from the urinary tract.

That the solution is not irritating to the mucous membranes of the bladder, ureters, and pelves of the kidneys, has been demonstrated by the fact that no urinary symptoms have been observed in the cases in which it has been used. Subsequent cystoscopic examinations have shown no evidence whatsoever of any inflammation of the vesical mucous membrane; the examination of the bladder, ureters and kidney pelves, in cases which have come to operation within a few hours or days after its use, have shown no evidence of any irritative action. In the animals into whose peritoneal cavities this solution has been introduced, there has been no sign of any peritonitis at autopsy, and all of the fluid has been absorbed in most instances. The careful neutralization of the solution has been emphasized previously, and it is due to this fact that no irritating action has been observed.

The solution, although exerting an inhibitory action on the growth of the ordinary bacteria, is not bactericidal. Moulds grow in it upon standing; therefore, it must be sterilized and kept sterile while being used.

A word may be said in regard to the introduction of the solution into the renal pelvis and ureter. This is done by the gravity method by means of a burette with a rubber-tubing connection and a properly fitting nozzle for the end of the ureteral catheter, the burette being held slightly above the level of the patient. This method is recognized by urologists at the present time as being the least dangerous and most successful for completely distending the renal pelvis. Injection by means of a syringe has fallen into disuse because of the great danger of over-distension of the pelvis, and the forcing of the solution into the renal parenchyma or into the peri-renal tissues. In practically all the cases of death reported as due to the use of collargol, this latter procedure was employed.

Pharmacologic Action of the Solution.

The pharmacologic action of this solution has been studied experimentally in dogs, cats, rabbits and guinea-pigs; fifty animals having been used altogether. In these animals, small doses, given intravenously, intraperitoneally, intramuscularly and subcutaneously, produced no effect. Larger doses have in a few instances produced diarrhœa, while still larger doses have caused death preceded by muscular twitchings, clonic convulsions and coma. These fatal doses, of course, were far above the ordinary limits of clinical usage. In a few instances 2 cc. of this fifteen per cent solution per kilogram (intraperitoneally and intramuscularly) proved fatal in these animals, much larger doses being required intravenously to produce death. Even these figures in the case of an ordinary man of 70 kg. would allow the use of 140 cc. of the solution, which would be ten times as great as that used in a simple pyelogram, and hundreds of times greater than any small amount that might be absorbed during the procedure. As a matter of fact, much larger amounts than this have been used in the renal pelvis without any ill effects.

The tolerance of these animals for the solution seemed to vary greatly with the method of administration; dogs, for instance, being much more tolerant of the solution intravenously than when it was given intraperitoneally. The reverse, however, was found to be true in the case of rabbits. Guinea-pigs tolerated the solution in much larger doses intraperitoneally than cats.

Outside the body the solution prevents the coagulation of the blood. When introduced into the circulation it causes no change in the cellular elements of the blood. The number of red and white blood cells and the hemoglobin content remain the same after its introduction.

In studying the effects of the intravenous injection of the solution, twelve dogs and two rabbits were used. In only one of these dogs did the solution prove acutely fatal, 5 cc. per kg. having caused death in five hours in Dog XXVII. One of the rabbits died three days after the injection and at autopsy marked parasitic infection was found, so that it is impossible to say whether the thorium solution was in any way responsible or not.

The intravenous injection of this fifteen per cent thorium solution, in dogs, in small amounts (10-15 cc.), causes first a rise in blood pressure with an increase in pulse rate, the respirations being also increased. All three quickly return to normal. However, if the small doses be repeated over a period of several hours, the animal being etherized by intratracheal insufflation, there will be a decrease in the depth of the respirations after each injection. These periods of decrease in respiration later become priods of apnœa, the respiration finally ceasing quite a while before the ventricular contractions stop. The ventricular contractions, as a rule, become quite irregular before they cease altogether. There is also a final drop in blood pressure, as would be expected. The cutting of the vagi has no effect upon these phenomena. By this method as much as 12 cc. per kg. (Dogs IX and XI) have been required to produce death. In a few of these dogs muscular twitchings followed by clonic convulsions were observed toward the end of the experiment (Figs. 3 and 4).

As much as 4 cc. per kg. (Dog XVIII) have been given at a single dose without any symptoms being observed, and with no effect on the phenolsulphonephthalein output or on the blood urea content. This animal was sacrificed in seventy days; the autopsy proved negative. There was no demonstrable change in kidney function, as indicated by these two methods of investigation, in any of the dogs to which ten and fifteen per cent thorium solution was administered intravenously (Figs. 5 and 6). In some of the dogs there was diuresis of short duration. In rabbits, 3 cc. per kg. of this fifteen per cent solution, when given in a single dose (Rabbit VII), produced

immediate muscular twitching and clonic convulsions followed by rapid and complete recovery, no untoward effect being observed afterward. Autopsy in this instance was also negative. Two cc. per kg. (Rabbit VIII) caused death in three days. At autopsy a generalized parasitic infection was found.

The solution was injected into the peritoneal cavity of five dogs, three cats, seven rabbits, and three guinea-pigs. It caused death in one instance in each of the different animals.

Three and a half cc. of this fifteen per cent solution per kg. in Dog XXI produced slight diarrhœa; no other effects were observed. Three cc. per kg. (Dog XIX) caused a bloody

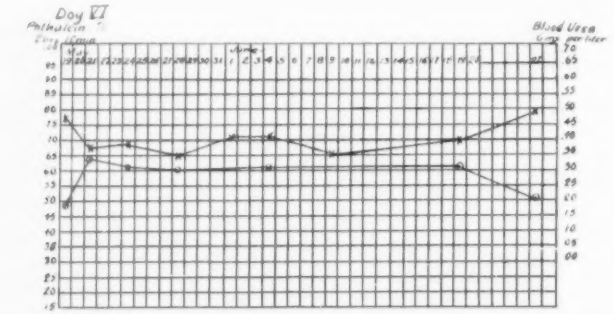


FIG. 5.—Chart of Dog VI, showing no change in phenolsulphonephthalein output or blood urea content after injection of 1 cc. per kg. of 10 per cent thorium solution.
X = phenolsulphonephthalein output for two hours and ten minutes.
° = blood urea, grams per liter.

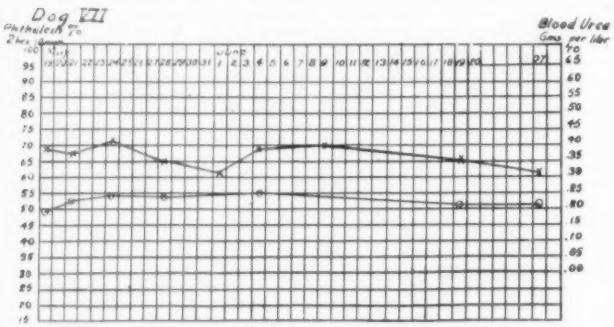


FIG. 6.—Chart of Dog VII, showing no change in phenolsulphonephthalein output or blood urea content after intravenous injection of 1.5 cc. per kg. of 10 per cent thorium solution.
X = phenolsulphonephthalein output for two hours and ten minutes.
° = blood urea, grams per liter.

diarrhœa for twenty-four hours following the injection, with prompt recovery; the animal was sacrificed in thirty-six days for a kymographic experiment. The autopsy showed central necrosis of the liver. All the other organs were normal. Two cc. per kg. (Dog VIII) proved fatal in eighteen hours after the injection. At autopsy this animal showed hemorrhagic gastroenteritis and congestion of all the organs. No fluid, however, was present in the peritoneal cavity and the peritoneal surfaces were smooth and glistening. Microscopically central necrosis of the liver was found. In cats, three cc. per kg. (Cat III) caused death in three days. This animal showed loss of appetite; it was dull and apathetic. At autopsy a small amount of clear fluid was found in the peritoneal cavity; the peritoneal surfaces were normal. All the organs were normal in gross appearance. Microscopically cloudy swelling of the liver was seen. Two cc. per kg. (Cat IV) produced no effect. This animal was sacrificed in eighty-four days, the autopsy showing generalized parasitic infection. One cc. per kg. (Cat II) produced no effect. This animal was sacrificed in ninety-four days, the autopsy showing nothing abnormal. In rabbits 10 cc. per kg. (Rabbit VII) produced death, preceded by convulsions, in twelve hours. The autopsy showed a small amount of bloody fluid in the peritoneal cavity; the peritoneal surfaces were normal. Seven and a half cc. per kg. in Rabbit IX produced no effect. In guinea-pigs 8 cc. per kg. (Guinea-pig IV) caused death in forty-eight hours. Some clear fluid was found in the peritoneal cavity at autopsy; the peritoneal surfaces and organs were normal in appearance. Three cc. per kg. (Guinea-pig III) showed no effect.

Intramuscularly, small quantities distributed over different portions of the body were absorbed, no effect being produced. In dogs, 2 cc. per kg. given deeply into the lumbar muscles (Dog XXXI) caused death in three days. Hemorrhage and necrosis were observed at the site of the injection and at autopsy congestion of all organs was found. In cats, 4 cc. per kg. (Cat VI) caused death in twenty-four hours. The autopsy showed a slight hemorrhage at the site of the injection, and bloody fluid in the pleural and pericardial cavities; microscopically central and midzonal necroses of the liver were seen.

Subcutaneously, small doses were well absorbed, producing no effects whatever if well distributed over the body. In dogs, 2 cc. per kg. (Dog XIV, who four days previously had received 1 cc. per kg. intraperitoneally) were followed by death in forty-eight hours. Muscular twitchings were observed for twenty-four hours preceding death. The autopsy showed hemorrhage at the site of the injection; there was no free fluid in the peritoneal cavity; all the organs were congested. In cats, 4 cc. per kg. (Cat V), caused death in twelve hours. The autopsy showed acute congestion of the spleen, petechial hemorrhages in the heart muscle, and central and midzonal necroses of the liver.

MODIFICATIONS OF THE SOLUTION.

With the idea of a possible simplification of the solution, various attempts were made to modify it, but these modifications, when tested experimentally, have either shown an increase in toxicity, or have been responsible for the production of certain symptoms that are not observed when the original solution is used.

Since the thorium content of the solution is alone responsible for its shadow-casting properties, as noted above, it was thought that a solution containing only the double neutral citrate of sodium and thorium would be a great step towards simplification.[3] This, however, in fifteen per cent concentration, proved

[3] I am indebted to Dr. H. A. B. Dunning, of the firm of Hynson, Westcott & Co., of this city, for the preparation of this double neutral citrate and the modified solutions employed in these experiments.

FIG. 7.—Normal renal pelvis and ureter.

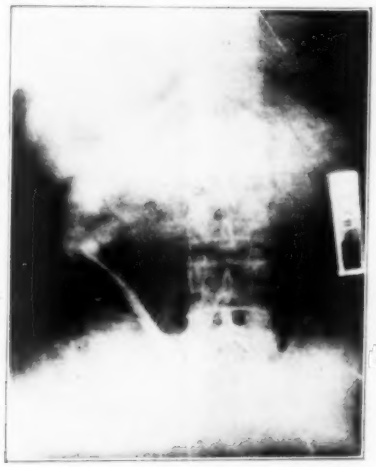


FIG. 10.—Accentuation of the shadow of a renal calculus by the thorium solution, a plain roentgenogram having shown no shadow.

FIG. 13.—Bilateral hydronephroses, and hydroureters, dilated and trabeculated bladder, dilated internal sphincter, due to congenital obstruction in posterior urethra.

FIG. 8.—Slightly irregular pelvis due to old chronic inflammatory process.

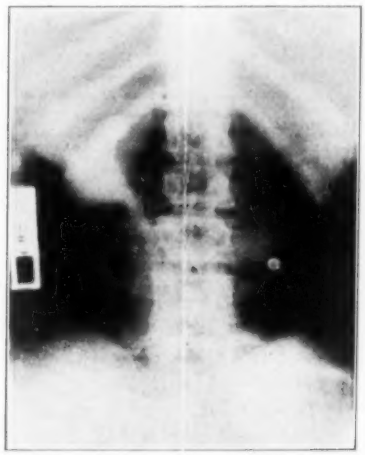


FIG. 11.—Moderate grade of hydronephrosis due to a calculus in the lower end of the left ureter.

FIG. 14.—Double pyelogram showing a slight hydronephrosis in the lower portion of the pelvis of the left kidney.

FIG. 9.—Kink in upper ureter due to aberrant vessels to lower pole of kidney, with a slight grade of hydronephrosis.

FIG. 12.—Large hydronephrosis due to a congenital stricture of the ureter.

FIG. 15.—Double pyelogram, showing similar types of renal pelvis on both sides.

FIG. 16.—Double pyelogram showing a bifid pelvis on the left; kink in lower end of right ureter.

FIG. 19.—Plain roentgenogram of bladder showing indefinite shadow in the bladder region due to numerous small calculi.

FIG. 22.—Cystogram. Case of tabes dorsalis showing trabeculated bladder with diverticulum, dilatation of the internal sphincter and funnel-shaped posterior urethra.

FIG. 17.—Horseshoe kidney; case of Dr. Guy L. Hunner.

FIG. 20.—Cystogram (same case as Fig. 19), the bladder being filled with ten per cent thorium solution.

FIG. 23.—Congenital hydronephrosis in a boy 11 years of age.

FIG. 18.—Cystogram showing trabeculated bladder with diverticulum, dilatation and kinking of right ureter.

FIG. 21.—Same case as in Figs. 19 and 20 after thorium solution had been allowed to flow out of the bladder, showing sponge-like shadow due to the differing degrees of opacity of the calculi and thorium solution.

FIG. 24.—Double pyelogram showing a double renal pelvis with a calculus in the upper pelvis and a bifurcated ureter on the left side.

quite toxic as is shown by the following experiments: An intravenous injection of 4 cc. per kg. (Dog XX) caused a bloody diarrhœa for twenty-four hours, beginning six hours after the injection, the diarrhœa ceasing by the beginning of the third day. The dog was dull and apathetic, and had no desire for food. Death occurred in seventy-two hours. The chief autopsy finding was central necrosis of the liver with congestion of the kidneys. Three cubic centimeters intravenously (Dog XVI) caused a marked diarrhœa for forty-eight hours following the injection, during which time the dog was very sick and stupid. This animal showed marked loss of appetite and weight. The total phenolsulphonephthalein output for two hours and ten minutes dropped from 88 per cent at the time of injection to 50 per cent on the thirty-fourth day, at which time the animal was sacrificed. At autopsy no unusual findings were observed grossly. Unfortunately, the sections were lost.

These experiments show that a solution containing the double neutral citrate alone could not be used. Sollman and Brown[1] investigated the pharmacologic action of the double citrate of sodium and thorium; these authors found that one gram per kg. given intravenously caused death immediately and that .5 gm. per kg. caused death after twenty-four hours. The results of the studies of these authors agree with mine, excepting in the autopsy findings. They report ulceration of the buccal mucous membrane and deposits of calcium in the organs; no such changes were found after the use of various doses of any of the thorium solutions that I have investigated. These authors furthermore state that the toxic effects of the double citrate may be largely accounted for by the sodium citrate content, for their experiments with sodium citrate alone gave practically the same results.

A solution made in the same way as the original solution, but in which thorium chloride was used in place of thorium nitrate in its preparation, caused diarrhœa for twenty-four hours in Dogs XXIII and XXVI. In each instance 4 cc. per kg. were given intravenously. These animals were sacrificed in forty-four and thirty-seven days, respectively, and the autopsies in both instances were negative.

A solution containing the double neutral citrate of sodium and thorium, fifteen per cent, and ten per cent of sodium citrate, caused immediate death in Dog XXIV, after 2.5 cc. per kg. had been given intravenously. The autopsy was negative. In Dog XXVIII, 4 cc. per kg., intravenously, caused death in eighteen days. For twenty-four hours following the injection there was marked muscular twitching and diarrhœa. However, there was prompt recovery from these symptoms, but the gradual loss of weight and appetite continued until death ensued. The autopsy findings in this instance were negative.

A solution containing fifteen per cent of the double neutral citrate of sodium and thorium and ten per cent each of sodium chloride and sodium citrate caused death in sixteen days after the intravenous injection of 4 cc. per kg. (Dog XXV). This dog was apparently well until three days before death, when he began having convulsions and was very dull and apathetic. Dog XXIX died at the end of an intravenous injection of 3 cc. per kg., the respirations ceasing before the ventricular contraction. The autopsy showed congestion of all the organs. Dog XXX, given 4 cc. per kg. intravenously, had diarrhœa for twenty-four hours with prompt recovery; there were no other symptoms. This animal was sacrificed in thirty days. The autopsy findings were negative.

From these observations, it is seen that the withdrawal of any of the component parts of the original solution would be harmful. The substitution of the chloride for the nitrate of thorium in the original solution produced diarrhœa.

[1] Sollman & Brown: "Pharmacologic Investigations on Thorium." Amer. Journ. Physiology, 1907, XVIII, 426-456.)

CLINICAL USES.

Since the introduction of this solution into the Urological Clinic of this hospital eight months ago, it has been used in one hundred and twenty-five cases without any untoward effects whatsoever having been observed.

From the table of eighty-seven pyelograms (pp. 162-163) it will be seen that there were nausea and vomiting following its use in four cases. These symptoms could be readily accounted for by the ureteral catheterization alone, for they occur fully as frequently in cases where this alone has been done and no injection has been made into the renal pelvis or ureter. In one of these cases, on account of the irritability of the bladder, the patient had to be etherized before ureteral catheterization could be attempted; the etherization could account for the nausea and vomiting in this case. In the table of cystograms it is seen that nausea and vomiting occurred in one case, and slight nausea and frequency of urination in another. In the first case the nausea and vomiting occurred some hours after the cystogram had been made and was due in all probability to some indiscretion in diet. In the second case the patient was quite nervous, this condition possibly being entirely responsible for the symptoms.

The largest amount used in the entire urinary tract in a single case was 600 cc. of a ten per cent solution introduced into the bladder, ureters and renal pelves of a boy twelve years of age. The roentgenogram (Fig. 13) in this instance showed a dilated and trabeculated bladder with dilatation of the internal sphincter, double hydroureters and hydronephroses, due to a congenital obstruction in the posterior urethra. This patient showed no change in the phenolsulphonephthalein output or blood urea content; nor has there been any interference with kidney function demonstrated in any of the cases. For pyelograms, from 5 to 150 cc. of a fifteen per cent solution have been used, and for cystograms from 30 to 930 cc. of a ten per cent solution.

CONCLUSIONS.

1. Thorium solution fulfils all the conditions necessary for an ideal pyelographic medium.

2. Clinically, there has never been the slightest evidence of toxicity in a series of one hundred and twenty-five cases, the amounts used in a single case varying from a few cubic centimeters to almost a litre. This alone is proof of its non-toxicity.

3. Experimentally, although in a few instances death has followed the injection of large doses into the peritoneal cavity

TABLE OF PYELOGRAMS. FIFTEEN PER CENT THORIUM SOLUTION.

No.	Plate No.	History No.	Name.	Age.	Diagnosis.	Pyelogram.	Quantity of thorium sol. injected.	Symptoms following injection.	Phenolsulphonephthalein output before injection.	Phenolsulphonephthalein output after injection.	Remarks.
1	247	4466	G. C.	19	Ureteral calculus	Pyelogram (S)		None	41%, half hour.		
2	257	4474	T. J. F.	48	Pyelitis—left	Pyelogram (S)		None	50%, half hour.		
3	263	4491	D. M.	48	Renal calculus	Pyelogram (S)		None	Half hour, 14%, R.; 30%, L.		Right nephrectomy.
	288				Hydronephrosis	Pyelogram (S)		None			Pyelitis, right.
4	273	4499	E. H.	50	Ureteral calculus	Pyelogram (S)		None			
5	275	4519	P. C. H.		Renal tuberculosis	Pyelogram (S)		None	Half hour, 10%, R.; 30%, L.	Total, 62%	Right nephrectomy.
6	278	4521	G. B.	32	Hydronephrosis	Pyelogram (D)	L-150 cc.	None	Total, 50%. 23%, R.; 0%, L.	Total, 67%	Plastic operation on pelvis of left kidney.
7	285	4534	F. W. H.	60	Renal calculus	Pyelogram (S)		None	Half hour, 15%, L.	Total, 55%	Right pyelotomy.
8	340	4658	M. Y.	39	Chr. urethritis	Pyelogram (S)		None	Half hour, 20%, R.; 15%, L.	Total, 50%.	
9	346	4676	R. McA.	19	Hemorrhagic nephritis	Pyelogram (D)	R-20 cc. L-12 cc.	None	Half hour, 6½%, R.; 12%, L. Transves., 27%.	Total, 38%	Tonsillectomy. Lavage of renal pelves with $AgNO_3$. Injection of horse serum.
10	350	4568	W. S.	55	Pyelonephritis	Pyelogram (S)	8 cc.	None	Half hour, 17½%, R.; Trace, L.	Total, 61%.	
11	352	4692	F. S. M.	56	Pyelonephritis	Pyelogram (D)		None	Half hour, 18%, R.; 8%, L.		Lavage of renal pelvis with $AgNO_3$ solution.
12	353	2299	T. L. C.		Pyelitis	Pyelogram (D)		Sl. nausea and vomiting.	Half hour, 18%, R.; 5%, L. Transves., 27%.		Lavage of renal pelvis with $AgNO_3$ solution.
13	355	4591	T. J. W.	60	Prostatic hypertrophy	Pyelogram (D)		None	Half hour, 14%, R.; 21%, L.	Total, 60%.	
14	354	2479	J. J. McG.	34	Hydronephrosis	Pyelogram (S)		None	Half hour, 50%, R.; 10%, L.		
15	187	4395	P. B.	12	Hydronephroses. Hydroureters. Septum post. urethra.	Pyelogram (D) Cystogram	600 cc. 10%	Sl. nausea and vomiting.	Total, 25%. Blood urea, 0.78 gms.	Total, 20% Bl. urea, 0.6 gms.	Etherization for cystoscopy. Suprapubic cystotomy with division of urethral septum.
16	190	4355	F. N.	19	Essential hematuria	Pyelogram (D)	R-5 cc. L-5 cc.	None None.	Total, 61%	Total, 62%	Lavage of renal pelvis with $AgNO_3$ solution.
17	198	4388	J. B.	65	Prostatic hypertrophy. Vesical calculus.	Pyelogram (S)		None	Total, 59%	Total, 59%	Perineal prostatectomy and lithotomy.
18	220	3106	W. L. C.	53	Prostatic hypertrophy. Pyelitis.	Pyelogram (S)	16 cc.	None	Total, 49%		Lavage of renal pelvis with $AgNO_3$ solution.
19	221	4439	J. W.	31	Ureteral calculus. Pyelonephritis.	Pyelogram (S)		None	Total, 60%	Total, 62%	Left nephrectomy.
20	221	4439	J. W.	31	Ureteral calculus. Pyelonephritis.	Pyelogram (S)		None	Total, 60%	Total, 62%	Left nephrectomy.
21	221	4439	J. W.	31	Ureteral calculus. Pyelonephritis.	Pyelogram (D)		None	Total, 60%	Total, 62%	Left nephrectomy.
22	222	4426	R. M.	35	Ureteral calculus	Pyelogram (S)		None	Total, 20%	Bl. urea, 1.04 gms.	Uretero-lithotomy.
23	230	4416	R. M.	35	Ureteral calculus	Pyelogram (S)		None	Bl. urea, .816 grm.		Uretero-lithotomy.
24	238	4443	F. F. H.	43	Chronic prostatitis and seminal vesiculitis.	Pyelogram (D)	R-8 cc. L-6 cc.	None.			
25	233	4438	D. S. B.	22	Ulcer of bladder. Cystitis and prostatitis.	Pyelogram (S)		None	Total, 63%	Total, 63%	Etherization for cystoscopy.
26	235	3847	C. W. K.	42	Renal calculus	Pyelogram (D)	L-25 cc.	None	Total, 55%	Total, 55%	Pyelotomy.
27	256	4449	P. M. E.	63	Hydronephrosis. Sl. Prostatic hypertrophy.	Pyelogram (D)		None	Half hour, 14%, R.; 15%, L.	Total, 52%.	
28	240	Gyn	M. K.		Pyelitis	Pyelogram (S)	16 cc.	None.			
29	252	4460	J. M.	24	Hydronephrosis	Pyelogram (D)	R-8 cc. L-16 cc.	None	Half hour, 22%, R.; 12%, L.	Total, 63%	Left nephrectomy.
30	245	4463	G. W. L.	42	Cystitis. Prostatitis.	Pyelogram (D)	R-14 cc. L-14 cc.	None	Half hour, 21%, R.; 21%, L.	Total, 59%.	
31	289	4538	F. Y.	31	Pyelitis (rt)	Pyelogram (D)		None	Half hour, 27%, R.; 22%, L.		
32	297	4568	W. S.	55	Pyelonephritis. Periurethral abscess.	Pyelogram (S)		None	Total, 61%	Total, 70%	Incision and drainage of periurethral abscess.
33	321	4568	W. S.	55	Pyelonephritis. Periurethral abscess.	Pyelogram (S)		None	Total, 61%	Total, 70%	Incision and drainage of periurethral abscess.
34	350	4568	W. S.	55	Pyelonephritis. Periurethral abscess.	Pyelogram (S)	R-8 cc.	None	Total, 61%	Total, 70%	Incision and drainage of periurethral abscess.
35	293	4574	H. A. M.	55	Renal calculus	Pyelogram (S)	R-15 cc.	None	Half hour, 16%, R.; 23%, L.		
36	295	4560	C. B.	48	Chr. prostatitis and Verumontanitis.	Pyelogram (S)		None	Half hour, 10%, R.; 22%, L.	Total, 63%.	
37	300	4599	M. G.	57	Ureteral calculus	Pyelogram (S)	L-13 cc.	None	Half hour, 22%, R.; 20%, L.		
38	323	4579	H. H. E.	45	Pyelitis (rt.)	Pyelogram (D)		None	Total, 64%	Total, 58%	Lavage of renal pelvis with $AgNO_3$ solution.
39	324	4617	R. T. D.	56	Pyelonephritis	Pyelogram (S)	R-4 cc.	Nausea and vomiting.	Half hour, trace, R.; 38% L.		Syringe injection.
40	325	4615	W. C. S.	47	Renal calculus. Pyelonephritis.	Pyelogram (D)	R-13 cc. L-9 cc.	None	Total, 50%	Total, 53%	Right nephrectomy.
41	265	4484	A. M. H.	26	Ureteral calculus	Pyelogram (D)	L-20 cc. R-8 cc.	None	Half hour, 21%, R.; 20%, L.	Total, 60%	Left ureterolithotomy.
42	279	4530	J. H. B.	35	Chronic prostatitis and seminal vesiculitis.	Pyelogram (S)		None		Total, 70%.	
43	283	4536	J. L.	36	Ureteral calculus. Hydronephrosis.	Pyelogram (S)	R-13 cc.	None	Total, 67%	Total, 64%	Right ureterolithotomy.
44	317	4602	W. H.	27	Renal and seminal tuberculosis.	Pyelogram (S)	R-16 cc.	None	Half hour, 35%, R.; trace, L.	Half hour, 30%, R.; trace, L.	Left nephrectomy.
45	211	4420	G. O.	30	Essential hematuria	Pyelogram (S)		None	Half hour, 22%, R.; 20%, L.		Lavage of renal pelvis with $AgNO_3$ solution.
46	326	4632	G. B.	24	Hydronephrosis. Double pyelitis.	Pyelogram (D)		None	Total, 73%		Exploration of right kidney.
47	333	1849	L. A.	39	Chr. prostatitis and seminal vesiculitis.	Pyelogram (D)		None	Half hour, 15%, R.; 15%, L.		
48	334	4369	B. G.	21	Vesical ulceration. Leucoplakia.	Pyelogram (D)	R-5 cc. L-4 cc.	None	Total, 72%		Suprapubic cystotomy, with cauterization of ulcerated areas.
49	320	4508	J. M.	63	Pyelonephritis. Cystitis	Pyelogram (D)	R-17½ cc. L-20 cc.	None	Total, 38%.		
50	356	4707	L. C.	35	Necrosis of kidney (lt)	Pyelogram (D)	R-7 cc. L-8 cc.	None	Half hour, 51%, R.; 0%, L.	Total, 42%	Left nephrectomy.
51	360	4727	F. S.	35	Chr. prostatitis	Pyelogram (S)	R-8 cc.	None	Total, 50%.		
52	382A	3120	C. L. P.	25	Renal tuberculosis	Pyelogram (S)		None	Total, 65%	Total, 55%	Right nephrectomy.
53	363	4632	G. B.	24	Hydronephrosis. Double pyelitis.	Pyelogram (S)	R-28 cc.	None	Total, 60%	Half hour, 30%	Exploration of right kidney.
54	369	4729	W. L.	56	Hydronephrosis	Pyelogram (D)		None.			
55	371	4719	L. C. H.	27	Renal tuberculosis	Pyelogram (D)	R-4 cc. L-3 cc.	None	Half hour, 20%, R.; 24%, L.	Total, 53%	Right nephrectomy.

TABLE OF PYELOGRAMS. FIFTEEN PER CENT THORIUM SOLUTION—*Cont'd.*

No.	Plate No.	History No.	Name.	Age.	Diagnosis.	Pyelogram.	Quantity of thorium sol. injected.	Symptoms following injection.	Phenolsulphonephthalein output before injection.	Phenolsulphonephthalein output after injection.	Remarks.
56	371	4719	L. C. H..	27	Renal tuberculosis	Pyelogram (S)	R-8½ cc...	None	Half hour, 20%, R.; 24%, L.	Total, 53%	Right nephrectomy.
57	377	5746	P. H.....	29	Pyonephrosis	Pyelogram (S)	.....	None	Half hour, 0% R.; 28%, L.	Total, 68%	Right nephrectomy.
58	382	4772	C. C.....	37	Renal tuberculosis	Pyelogram (S)	.....	None	Half hour, 33%, R.; 5%, L.	Total, 68%	Left nephrectomy.
59	381	4806	S. K.....	32	Ureteral calculus	Pyelogram (S)	R-10 cc...	None.			
60	387	4777	B. O. B..	35	Renal calculi	Pyelogram (D)	.....	None	Half hour, 30%, R.; 21%, L.	Total, 62%	Left pyelotomy.
61	395	4803	H. K.....	27	Pyelitis (rt)	Pyelogram (S)	R-8 cc....	None	Half hour, 35%.....	Half hour, 38%	Lavage of renal pelvis with $AgNO_3$ solution.
62	410	4793	H. K.....	27	Pyelitis (rt)	Pyelogram (S)	R-7½ cc...	None	Half hour, 35%.....	Half hour, 38%	Lavage of renal pelvis with $AgNO_3$ solution.
63	396	4808	C. H. R...	42	Ureteral calculus (rt)	Pyelogram (S)	.....	None	.....	.....	Ureterolithotomy.
64	401	4808	C. H. R...	42	Ureteral calculus (rt)	Pyelogram (S)	.....	None	.....	.....	Ureterolithotomy.
65	294	4801	F. W. G..	41	Prostatitis and seminal vesiculitis.	Injection of seminal vesicles.	.....	None.			
66	405	4824	W. M. P..	29	Nephralgia	Pyelogram (S)	.....	None.			
67	407	4816	W.E.McG	56	Renal calculi. Double renal pelvis and ureter.	Pyelogram (D)	R-7 cc.... L-13 cc...	None	Total, 51%.		
68	408	4841	A. S. H...	..	Chr. prostatitis	Pyelogram (D)	.....	None.			
69	420	4858	R. K. H..	58	Nephralgia	Pyelogram (S)	.....	None	Half hour, 22%, R.; 22%, L.		
70	424	4869	H. W. F..	52	Chr. prostatitis. Verumontanitis.	Pyelogram (S)	R-10 cc...	None	Total, 49%.		
71	429	4854	F. H.....	33	Median bar hypertrophy....	Pyelogram (S)	.....	Sl. nausea	.....	Total, 60%	Punch operation.
72	431	3189	C. P. F...	25	Median bar hypertrophy....	Pyelogram (D)	.....	None	Half hour, 18%, R. 13%, L.; transves., 25%.	.....	Punch operation.
73	437	4897	C. J.....	64	Prostatic hypertrophy	Pyelogram (S)	R-11 cc...	None.			
74	445	4906	W. H. K..	58	Chr. prostatitis	Pyelogram (D)	R-9 cc.... L-8 cc....	None	Half hour, 15%, R.; 15%, L.		
75	443	4892	H. M. S..	40	Chr. Cystitis. Prostatic Hyper. (Median bar.)	Pyelogram (S)	R-5 cc....	None	Half hour, 22%, R.; transves., 5%.		
76	447	4916	J. G.....	39	Essential hematuria	Pyelogram (D)	R-20 cc... L-16 cc...	None	Half hour, 0%, R.; 15%, L.	Total, 55%.	
77	460	4916	J. G.....	39	Essential hematuria	Pyelogram (D)	R-10 cc... L-12 cc...	None	Half hour, 7%, R.: 10%, L.; transves., 7½%.	Total, 48%.	
78	448	4921	B. G.....	22	Perinephritic abscess (rt.)..	Pyelogram (S)	R-15 cc...	None	.....	Total, 75%	Incision and drainage of perinephritic abscess.
79	452	4972	F. M. B..	21	Gonorrhœal pyelitis	Pyelogram (D)	.....	None	.....	.....	Lavage of pelvis with $AgNO_3$ solution.
80	455	....	P. M.....	40	Chr. Cystitis and Chr. Prostatitis.	Pyelogram (D)	.....	None.			
81	462	5002	J. N.....	..	Double pyelitis	Pyelogram (D)	R-10 cc... L-12 cc...	None	Half hour, 14%, R.; 18%, L.	.....	Lavage of pelves with $AgNO_3$ solution.
82	465	4901	C. F. P....	39	Renal tuberculosis	Pyelogram (S)	.....	None	Half hour, 5%, R.; 8%, L.; transves., Tr.	.....	Right nephrectomy.
83	463	4976	R. H.....	53	Essential hematuria	Pyelogram (S)	.....	None	Half hour, 20%, R.; 8%, L.; transves., 8%.	.....	Lavage of renal pelves with $AgNO_3$ solution and injection of horse serum.
84	468	4976	R. H.....	53	Essential hematuria	Pyelogram (S)	.....	None	Half hour, 20%, R.; 8%, L.; transves., 8%.	.....	Lavage of renal pelves with $AgNO_3$ solution and injection of horse serum.
85	470	4982	C. S.....	28	Double pyelitis	Pyelogram (D)	R-6 cc.... L-6 cc....	None	Half hour, 17%, R.; 13%, L.; transves., 1%.	.....	Lavage of renal pelves with $AgNO_3$ solution.
86	472	4985	D. C. B...	38	Pyelitis (rt.)	Pyelogram (D)	L-14 cc...	None	.....	70 min.. 30%	Lavage of renal pelvis with $AgNO_3$ solution.
87	476	4962	H. K. B..	29	Renal tuberculosis bilateral.	Pyelogram (S)	.....	None	Half hour, 28%, R.; transves., 6%.	1st half hour, 30%; 2d, 12%; total, 42%.	

(S)=Single. (D)=Double. R=Right kidney. L=Left kidney. Transves.=Transvesical collection of phenolsulphonephthalein output. Total=Phenolsulphonephthalein output for two hours and ten minutes.

TABLE OF CYSTOGRAMS. TEN PER CENT THORIUM SOLUTIONS.

No.	Plate No.	History No.	Name.	Age.	Diagnosis.	Cystogram.	Quantity of thorium sol. injected.	Symptoms following injection.
1	185	....	S. V.	....	Chr. prostatitis.....	Cystogram...		
2	213	4173	W. Z.	49	Tabes dorsalis.....	Cystogram...	600 cc.	None.
3	214	4125	G. C. T.	56	Prostatic hypertrophy.	Cystogram...	930 cc.	Nausea and vomiting.
4	229	4438	D. S. B.	22	Ulcer of bladder, cystitis, contracted bladder.	Cystogram...	150 cc.	None.
5	226	4430	P. H.	45	Tabes dorsalis.....	Cystogram, Rt. kidney	450 cc.	None.
6	234	4136	M. K.	58	Prostatic hypertrophy,	Cystogram...	250 cc.	None.
7	249	1778	J. B. C.	49	Prostatic hypertrophy, cerebro-spinal lues.	Cystogram...	400 cc.	None.
8	255	4459	P. H.	62	Carcinoma of bladder..	Cystogram...	.....	None.
9	256	4493	H. H. H.	....	Tabes(?), prostatic hypertrophy.	Cystogram...	.....	None.
10	250	3376	W. C.	59	Cerebro-spinal lues....	Cystogram...	275 cc.	None.
11	203	4369	B. G.	21	Cystitis. Leukoplakia.	Cystogram...	30 cc.	None.
12	244	4460	J. M.	24	Hydronephrosis.....	Cystogram...	.....	None.
13	330	4648	J. G.	62	Tabes dorsalis.....	Cystogram...	450 cc.	None.
14	298	4523	M. S.	55	Cerebro-spinal lues....	Cystogram...	425 cc.	None.
15	310	4573	J. F. H.	48	Cerebro-spinal lues....	Cystogram...	725 cc.	None.
16	319	4591	T. W.	60	Prostatic hypertrophy, Vesical calculi.	Cystogram...	200 cc.	None.
17	337	4641	J. J. W.	67	Prostatic hypertrophy. Vesical calculi.	Cystogram...	125 cc.	None.
18	358	4716	E. E. W	37	Tabes(?).....	Cystogram...	.....	None.
19	362	4717	V. W.	42	Tabes.....	Cystogram...	460 cc.	None.
20	364	4723	D. C. O.	38	Cerebro-spinal lues....	Cystogram...	525 cc.	None.
21	374	4773	S. P. B.	77	Prostatic hypertrophy. Vesical calculi.	Cystogram...	75 cc.	None.
22	400	4811	R. L.	51	Retro-vesical sarcoma.	Cystogram...	300 cc.	None.
23	413	4592	A. B.	43	Tuberculous pyonephrosis (right).	Cystogram...	15%	None.
24	411	4088	K. E. K.	45	Median Bar hypertrophy.	Cystogram...	500 cc.	Nausea and frequency.
25	415	4842	C. M. S.	55	Carcinoma of prostate. Vesical calculi.	Cystogram...	.....	None.
26	431	4885	S. R. D.	48	Hypertrophy of trigone. Contracted vesical neck.	Cystogram...	750 cc.	None.
27	444	4881	H. F.	48	Diverticulum.....	Cystogram...	200 cc.	None.
28	450	4664	W. K. C.	60	Prostatic hypertrophy.	Cystogram...	300 cc.	None.
29	453	4927	A. B.	47	Prostatic hypertrophy.	Cystogram...	250 cc.	None.

and tissues of animals, larger doses intraperitoneally and intravenously have produced no ill effects.

4. That the solution is non-irritating is shown by the absence of urinary symptoms after its use, and the absolute lack of any such evidence cystoscopically, and at operation.

5. The pyelograms and cystograms made with this solution show a splendid shadow which possesses an unusual clearness of delineation.

6. The solution is clear and watery; therefore it possesses a great degree of fluidity, permitting its ready elimination from the urinary tract.

7. It is perfectly clean and does not stain the linen. In this particular it possesses another marked advantage over other solutions, particularly those of the silver salts.

8. It is quite inexpensive, being about one-third as costly as collargol.

I desire to express my sincere thanks to Dr. Hugh H. Young, Director of the James Buchanan Brady Urological Institute, for his constant and enthusiastic interest throughout the course of this work; to Dr. C. A. Waters, of the Department of Roentgenology, for his invaluable assistance in the roentgenographic work; to Dr. E. K. Marshall, of the Department of Pharmacology, and to Dr. George Pierce, chemist of the James Buchanan Brady Urological Institute, for their helpful suggestions; to Dr. Montrose T. Burrows, of the Department of Pathology, for his kind assistance in reviewing the pathological material; and to Dr. W. S. Gorton, physicist of the James Buchanan Brady Urological Institute.

DISCUSSION.

DR. HUNNER: We ought to congratulate Dr. Burns on this very important contribution for those who work in urology. In working in a special line, as I have been doing for some time; viz., on ureter stricture, I have regretted often not having X-ray pictures of the condition of the dilated pelvis and the dilated ureter above the point of stricture. I have not felt justified in using the older solutions, such as collargol, because of the actual danger to the patient, and because in those particular cases it was not going to do the patient any good. A diagnosis could be made with the means at hand and it did not seem justifiable to go further. Now, from the experience I have had with thorium solution, I feel that we are perfectly justified in going further and getting an actual picture as a matter of record and to demonstrate to others the condition, without any added risk to the patient. I have always felt we were not justified in using collargol except in rare instances where perhaps there was doubt as to whether we were dealing with a tumor of the kidney, or in some such case where we actually needed an X-ray picture. The thorium method described by Dr. Burns this evening will be of great value in many cases.

A STATISTICAL STUDY OF 635 LABORS WITH THE OCCIPUT POSTERIOR.

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INTRODUCTION.

The recent American literature on the subject of obliquely posterior positions of the occiput has indicated such a widespread belief in the unfavorableness of this common occurrence, and such radical opinions with regard to the proper methods of treatment, that this study was undertaken for the purpose of learning from our clinical experience whether there is any justifiable basis for such views. We have always viewed these cases with perfect equanimity and have been impressed with their benignity, but so far without any definite statistical evidence of our own in favor of such a view. The occiput obliquely posterior presentations have always been a stumbling block for physicians, and only somewhat recently have the conservative obstetricians come to the conclusion that they are little, if any, worse than the anterior varieties. However, this view seems not to be universal, for, only within the past year, an American author has advocated Cæsarean section in certain cases of this class, even in the absence of any other indication, and the majority of writers refer repeatedly to the marked difficulties encountered in these cases.

The following points have been studied and will be considered in order: Frequency, internal rotation, time of rupture of the membranes, character of the delivery, necessary operative measures, indications for operations, infant mortality, duration of labor, type of pelvis, size of the child, and maternal morbidity and mortality. The first portion of the article is devoted to the presentation of the statistical findings; in the second portion the historical aspects are considered and a short discussion of the various findings is attempted.

STATISTICAL FINDINGS.

Material.—The histories of the first 7500 patients admitted to the Obstetrical Ward of the Johns Hopkins Hospital up to November, 1915, were examined and a note was made of the position of the child, as determined by abdominal palpation and by vaginal touch. The latter was always given preference over the former as being more accurate, but where no vaginal examinations were made the findings on palpation were considered final. Of the total number of admissions, 1730 were not available for our study. This group includes patients that were classified as " not pregnant," " not delivered," " admitted post partum," etc., as well as those in whom no definite diagnosis was made, usually because the patient was admitted very late in labor. Accordingly, 5770 cases, representing 5801 children, were available for analysis, and the following table shows the frequency with which the various presentations were noted:

TABLE 1.—FREQUENCY OF THE VARIOUS PRESENTATIONS.

	Number.	Percentage.
Vertex	5488	94.60
Face	20	.34
Brow	7	.13
Breech	226	3.87
Transverse	56	.96
Compound	4	.07
	5801 *	99.97

* Thirty-one cases of twin pregnancy are included.

Table 2 shows the incidence of the various varieties in the 5488 vertex presentations.

TABLE 2.—INCIDENCE OF VARIETIES OF VERTEX PRESENTATIONS.

Position.	Number.	Percentage.
L. O. A.	2613	47.61
R. O. A.	1046	19.06
L. O. T.	706	12.86
R. O. T.	488	8.89
L. O. P.	181	3.30
R. O. P.	437	7.96
O. P.	17	.31

Frequency.—From Table 2 it is seen that there were 635 cases of occiput posterior among 5488 vertex presentations, an incidence of 11.57 per cent. The division into right and left varieties is also indicated. These figures are considerably lower than those usually given. The discrepancy is probably explained by the fact that the majority of the patients applied for admission only when labor was well advanced, and after a certain amount of internal rotation had taken place.

Except in the cases complicated by contracted pelvis, in which the head usually engages with the sagittal suture transverse, it is probable that a large proportion of the cases, registered as L. O. T. and R. O. T., originated as obliquely posterior positions. The only objection to such an assumption is the greater incidence of the former in our series, which would indicate that almost as many cases had originated in L. O. P. as in R. O. P., which is contrary to the general experience. Consequently, it has seemed advisable to limit our consideration to the cases in which a positive diagnosis of an actual posterior position had been made.

Internal Rotation.—A study of our histories gives the following information concerning this cardinal movement in the mechanism of labor:

TABLE 3.—CHARACTER OF INTERNAL ROTATION (SPONTANEOUS AND OPERATIVE).

	Spont.	Oper.	Total
Rotation through 135° to symphysis (O. A.)	419	77	496
Rotation through 45° to hollow of sacrum (O. P.)	70	10	80
	489	87	576
No rotation permitted (version or Cæsarean section)			46
No note on direction of rotation			7
No rotation (born in oblique diameter)			6
			635

With regard to the question of internal rotation, interest settles on the cases of spontaneous rotation as giving an index of the normal incidence. This was observed in 487 cases, and in 419 or 85.8 per cent the occiput turned toward the symphysis, while in the remaining 70 or 14.2 per cent the occiput was toward the sacrum.

A certain amount of information was gathered with regard to the influence of the factors that are usually brought forward to explain rotation.

In 22 cases it was noted in the histories that the head was "poorly flexed." Of these, 11 rotated spontaneously, 7 to O. A. and 4 to O. P. This finding substantiates the observation long since made that poor flexion interferes with rotation of any kind and tends to cause posterior rotation in a certain number of cases.

Of the 70 cases in which spontaneous posterior rotation was observed, 35, or 50 per cent, occurred in primiparæ (women who had never given birth to a viable child). As the number of primiparæ in the entire series was 316, or 49.76 per cent, it is apparent that the parity of the patient, and consequently the multiparous condition of the pelvic floor, cannot be held accountable for posterior rotation.

A factor which seemed to bear a causal relation to rotation of the occiput into the hollow of the sacrum was discovered in studying the direction of rotation in the various types of contracted pelves.

TABLE 4.—DIRECTION AND METHOD OF ROTATION IN CASES WITH CONTRACTED PELVIS.

Type of pelvis.	Rotated to symphysis. (O. A.)				Rotated to hollow of sacrum. (O. P.)			
	Spont.		Oper.		Spont.		Oper.	
	No.	%	No.	%	No.	%	No.	%
Generally contracted	49	81.6	8	13.3	2	3.3	1	1.6
Simple flat	7	77.7	1	11.1	1	11.1	0	....
Rachitic	10	71.4	3	21.4	1	7.1	0	....
Typical funnel	15	44.1	10	29.4	8	23.5	1	2.9
Generally contracted and flat funnel	6	54.5	4	36.3	1	9.1	0	....

From this table, considering spontaneous rotation alone, it is seen that in the usual types of contracted pelvis, the occiput rarely rotates posteriorly. In the group of cases marked by inlet contraction alone (generally contracted, simple flat and rachitic), rotation was noted in 83 cases, and in 70 of these it occurred spontaneously. Of these 70, in only 4, or 5.71 per cent, did the occiput rotate posteriorly; whereas in the 23 cases of typical funnel pelvis, in which spontaneous rotation occurred, it turned toward the sacrum in 8 cases, a percentage of 34.7. When the outlet contraction was complicated by a contraction at the brim (generally contracted and flat funnel), one case out of 7, or 14.3 per cent, showed posterior rotation. From the table it is very evident that funnel pelves, in addition to predisposing toward rotation into the hollow of the sacrum, have a marked tendency to interfere

with rotation in any direction, and consequently the incidence of operative rotation is considerably increased. In the group of inlet contractions, out of 83 cases operative rotation was necessary in 13, or 15.6 per cent, while in 45 cases of typical funnel pelvis it was necessary in 15, or 33.3 per cent.

That this is more than a coincidence is indicated by the findings for the normal pelves. Here there are two divisions, separated at the period when outlet mensuration became a routine procedure. In the former, outlet contractions were usually overlooked, while in the latter they were recognized and placed in a separate category.

TABLE 5.—ROTATION IN NORMAL PELVES.

	Rotated to symphysis. (O. A.)				Rotated to hollow of sacrum. (O. P.)			
	Spont.		Oper.		Spont.		Oper.	
	No.	%	No.	%	No.	%	No.	%
Before outlet mensuration was instituted	114	68.6	26	15.6	24	14.4	2	1.2
After routine outlet mensuration was instituted	217	77.2	25	8.9	32	11.3	7	2.5

From Table 5 it appears that, in the former period when funnel pelves were not recognized, there was a smaller percentage of spontaneous anterior rotations and a larger percentage of operative rotations than in the second group, in which funnel pelves were recognized and classified as such. Considering spontaneous rotation alone, it is seen that, in the first group, consisting of 138 cases, posterior rotation occurred in 24, or 17.4 per cent, whereas in the second group, consisting of 249 cases, this outcome was noted only 32 times, or 12.9 per cent.

These observations on the effect of pelvic contraction upon internal rotation would indicate that resistance at the superior strait favors anterior rotation, but resistance at the inferior strait tends to rotate the occiput into the hollow of the sacrum and to increase the necessity for operative rotation.

The observations made upon rotation in premature and mature fetuses emphasizes the well-known fact that children with small heads tend to rotate posteriorly. Of the 71 cases in which the children weighed less than 2500 gm., rotation was observed in 58; in 10 there was no rotation, because Cæsarean section or version was done, and in 3 no note was made as to the direction of rotation. Of these 58 cases, in 19, or 32.7 per cent, the occiput rotated posteriorly, and in 39, or 67.3 per cent, anteriorly. This makes the occurrence of the former nearly three times as frequent in premature as in mature children.

It is thus seen that faulty flexion of the head, funnel pelvis, and the small size of the child are three factors that favor posterior rotation and that contraction at the superior strait prevents such rotation.

Rupture of the Membranes.—In each case the time of rupture of the membranes was noted, together with the size of the cervix when rupture occurred. In 33 cases these data were not given and could not be inferred from the histories. In 28 additional cases the membranes were artificially ruptured early in labor, at the time of operation, and before there had been any reasonable chance of their spontaneous rupture. Excluding these two groups, there remained 574 cases in which there were satisfactory data concerning the time at which the membranes ruptured.

It was found that in 449 cases, or 78.2 per cent, the membranes had remained intact until the cervix was more than half dilated (5.0 cm.), whereas premature rupture had occurred in 125 cases, or 21.8 per cent. (It was thought that the term "premature rupture" might well be limited to rupture before half dilatation of the cervix, inasmuch as rupture of the membranes after the cervix is that size is rarely a complication of any moment.) Furthermore, it is interesting to note that in 179 cases, or 31.2 per cent, artificial rupture was resorted to after full dilatation.

In order to determine whether contraction of the pelvic inlet had any additional effect upon the incidence of this accident, the 121 cases associated with contracted pelvis were analyzed, and 101 cases were found in which data were available. Of these, in 25, or 24.7 per cent, spontaneous early rupture occurred. It is somewhat surprising that the difference is not more marked.

Character of Delivery.—Spontaneous delivery occurred in 489 cases, or 77.1 per cent of the entire series. In reviewing the movement of internal rotation in these cases the following facts were discovered:

TABLE 6.—ROTATION IN THE CASES OF SPONTANEOUS DELIVERY.

Rotated through 135° to the symphysis	414
Rotated through 45° to the hollow of the sacrum	62
Rotation not noted	8
No rotation—born in the oblique diameter	5
	489

By reference to Table 3, in which the direction of the rotation in all the cases is noted, it will be observed that spontaneous rotation through 135° to the symphysis occurred in 419 cases; and from the table above it is found that in 414, or 98.8 per cent of these, spontaneous labors occurred, whereas, among the 70 cases with spontaneous rotation into the hollow of the sacrum, 62, or 88.6 per cent, of the women were delivered without assistance. Thus it is evident that, when the usual anterior rotation occurs spontaneously, there is a minimal chance that artificial delivery will be indicated, whereas the anomalous spontaneous rotation into the hollow of the sacrum is followed by the need for interference in about 10 per cent of the cases, or ten times as frequently as in the usual anterior rotation. In spite of this, rotation into the hollow of the sacrum is not so serious a complication as is generally thought, because 10 per cent is comparatively a very low operative incidence.

Operative delivery was required in 146 cases, or 22.9 per cent. The following operations were performed:

TABLE 7.—LIST OF OPERATIVE PROCEDURES.

Version and extraction		39
Cæsarean section (abdominal)		7
Forceps.		
Rotation to symphysis (O. A.)		
Scanzonian (double application)	high	6
	mid	6
	low	1
Single application—occiput still posterior (R. O. P. and L. O. P.).	high	0
	mid	4
	low	0
After complete spontaneous anterior rotation (O. A.)	high	0
	mid	0
	low	5
After spontaneous rotation to an obliquely anterior position (L. O. A. and R. O. A.).	high	1
	mid	1
	low	14
After spontaneous rotation to a transverse position (L. O. T. and R. O. T.).	high	1
	mid	10
	low	1
After manual rotation to an obliquely anterior position (L. O. A. and R. O. A.).	high	1
	mid	1
	low	4
After manual rotation to a transverse position (L. O. T. and R. O. T.).	high	8
	mid	10
	low	8
Rotation to hollow of sacrum (O. P.).		
After complete spontaneous rotation into the hollow of the sacrum.	high	0
	mid	1
	low	7
After accidental instrumental rotation into the hollow of the sacrum.	high	0
	mid	3
	low	0
After intentional rotation into the hollow of the sacrum.	high	0
	mid	3
	low	3
Incomplete rotation.		
Accidentally delivered in R. O. T. from an original R. O. P.	low	1

The various accessory operations, such as manual dilatation, vaginal hysterotomy and induction of labor, have been disregarded.

The number of patients delivered by the various types of forceps operation is of interest as showing the course of development of our present treatment. When the clinic first opened, the Scanzonian operation was usually performed when rotation had not occurred spontaneously, but after a short period the method of manual rotation followed by a single application of forceps was given a trial and proved so successful that it is now the usual method of treatment. In the latter half of the series there were only two cases of double application, the procedure being reserved for the rare cases in which manual rotation is impossible. In the course of my five years' association with the service I have never even seen the operation performed. An account of our present methods of treatment will be presented in the latter part of this article.

Indications for Delivery.—The following table gives the indications for operative delivery as stated in the histories. In some instances more than one indication were given, but usually by reading the preliminary note it was possible to estimate their relative importance, and the classification has been made according to what seemed to be the most important in the individual case.

TABLE 8.—INDICATIONS FOR OPERATIONS.

	Number.	Percentage.
Group A—Possibly due to the position.		
Delay on the perineum	34	23.29
Delay in mid-pelvis	31	21.23
Maternal exhaustion	23	15.75
Group B—Not due to the position.		
Pelvic dystocia	17	11.64
Eclampsia and toxemia	13	8.90
Placenta praevia and premature separation of the placenta	6	4.11
Cardiac disease	5	3.42
Fetal asphyxia	6	4.11
Prolapsed cord	4	2.74
Twin pregnancy	2	1.37
Ventro-fixation of uterus	1	0.68
Various rare conditions	4	2.74
	146	99.98

Of these, only the cases in Group A can possibly be considered as being due, even in part, to the position itself. Moreover, in the 88 operative cases in this group, there were 18 forceps deliveries performed after spontaneous rotation to the symphysis or to the obliquely anterior position had occurred. This fact of the spontaneous conversion into the favorable anterior variety removes these cases from the category of those in which the original posterior position was a factor in determining the need for intervention. This reduction leaves 70 cases in which the need for operation could possibly be attributed to the posterior position. This represents 47.94 per cent of the 146 operative cases, or 11.02 per cent of the entire series, but it must be remembered that other factors, such as inertia uteri and rigid perineum, were undoubtedly responsible for a certain rather large share. Any attempt to divide the cases of delay in mid-pelvis and on the perineum, on the basis of inertia or rigidity, introduces such a large personal element, unless all observations are made by the same individual, that no such classification was attempted. Even disregarding the possible reduction in this direction, it is very apparent that occiput posteriors should rarely of themselves offer definite indications for operative procedures.

If our series of cases is divided into two parts approximately at the middle, we find that the operative frequency in the second half is appreciably smaller than during the years preceding, and that the three indications for operations in Group A, possibly indicative of dystocia due to the position, are less in evidence. Thus, in the first part—326 cases—the operative frequency was 25.1 per cent (82 operations), and 55, or 67.0 per cent, of the operations were done for Group A indications. In 12 of these cases there had been a spontaneous anterior rotation, which reduced the percentage to 52.4 per cent. In the second part—309 cases—there were 64 operations, 20.7 per cent, and 33, or 51.6 per cent, were done for Group A indi-

cations. In 6 cases there had been spontaneous rotation anteriorly and the corrected percentage is only 42.2 per cent.

This interesting reduction in operative frequency is indicative of the greater conservatism which has come with a fuller appreciation of the resources of Nature in dealing with cases with the occiput obliquely posterior. At the present time, all vertex presentations are viewed as equally benign, and absolutely no apprehension is felt when an occiput posterior is diagnosed. As is seen, the great majority of the uncomplicated cases terminate in spontaneous delivery. With the exception of low forceps, which is viewed as an almost uniformly successful operative procedure, operations are usually deferred until there is a maternal or fetal indication and, unless the duration of labor is very markedly prolonged, operations are not done on a pure time indication.

Infant Mortality.—The gross infant mortality, including all children in the series which were still-born or died during the first two weeks, was 52, or 8.17 per cent. The causes of death, as accurately as could be determined, are shown in the following table:

TABLE 9.—CAUSES OF INFANT DEATHS.

	Number.	Percentage.
Prematurity	12	23.1
Operation (no other cause evident)	11	21.1
Syphilis (macerated fetuses)	9	17.3
Still-born (spontaneous labor)	5	9.6
Eclampsia	3	5.7
Prolapse of cord	3	5.7
Placenta prævia	3	5.7
Congenital anomalies	3	5.7
Died after birth (cause unknown)	2	3.9
Premature separation of placenta	1	1.9
	52	99.7

Of this total of 52, 24 weighed less than 2500 gm., and consequently may be excluded, leaving 28 deaths in the 564 mature children—a percentage of 4.96. When this is compared with Williams' figures for the total infant mortality in the first 10,000 cases in the Obstetrical Service of the Johns Hopkins Hospital, it is seen to be not much greater. He found 3.71 per cent of deaths among the mature children, using 2500 gm. as the lower weight limit for maturity. A comparison of these figures would indicate that the infant mortality is increased about 1.0 per cent in the cases of occiput posterior.

An analysis of the 28 deaths among the mature infants shows:

TABLE 10.—CAUSES OF DEATH IN MATURE CHILDREN.

Operation (no other cause evident)	11
Still-born (spontaneous delivery)	5
Eclampsia	3
Placenta prævia	3
Prolapse of cord	2
Syphilis	2
Died after birth (cause unknown)	1
Congenital anomaly	1

In this series, only those deaths incident to operation, 11 in number, and those due to asphyxia in which labor was spontaneous, 5 in number, can be regarded as in any way dependent upon the position. Thus, 2.83 per cent of the mature children perished as a result of delivery. Considering that five of these cases were complicated by contracted pelvis, it is seen that the child presenting with the occiput obliquely posterior has a chance of survival that is but little smaller than if the laws of gravitation or accommodation had ordained an anterior variety.

Duration of Labor.—The total duration of labor and the duration of the second stage were noted, whenever given, and the averages in the various classes of cases appear in the following tables. In the first place the usual arithmetic averages were computed and then an attempt was made to establish the various modes. Statisticians prefer the latter method as indicating much more closely the probabilities in any particular case. The arithmetic average is computed by adding the durations of the labors in the series and then dividing by the number of cases, whereas the mode is established by separating the cases into groups according to the duration of labor and determining in which group the greatest number of cases appear. If there is a sufficient number of cases the curve, if one be plotted, will rise gradually to the mode and then fall away on the other side.

TABLE 11.—ARITHMETIC AVERAGES FOR DURATION OF LABOR AND SECOND STAGE.

Para.	Rotation.	Labor.	No. of Cases.	Duration of Labor.	No. of Cases.	Duration of 2d Stage.
Primiparæ	Anterior	Spontaneous	186	18 hr. 27 m.	186	1 hr. 29 m.
Primiparæ	Anterior	Operative	55	29 hr. 11 m.	52	3 hr. 1 m.
Primiparæ	Posterior	Spontaneous	30	17 hr. 13 m.	30	1 hr. 30 m.
Primiparæ	Posterior	Operative	8	15 hr. 30 m.	8	3 hr. 17 m.
Multiparæ	Anterior	Spontaneous	221	12 hr. 00 m.	222	50 m.
Multiparæ	Anterior	Operative	16	21 hr. 23 m.	17	2 hr. 53 m.
Multiparæ	Posterior	Spontaneous	29	11 hr. 36 m.	29	1 hr. 4 m.
Multiparæ	Posterior	Operative	9	12 hr. 32 m.	9	2 hr. 33 m.

It is noted that in all classes the arithmetic average of the duration of labor is somewhat longer than the figures usually given for normal labor, but still the difference is very moderate. It is interesting that, in those cases in which spontaneous labor followed rotation of the occiput into the hollow of the sacrum, the duration of labor was shorter than in the cases of anterior rotation with spontaneous delivery. In the primiparæ, the duration of the second stage was almost identical whether the occiput rotated anteriorly or posteriorly, and in the multiparæ posterior rotation only slightly prolonged this stage. It was thought that backward rotation would considerably delay delivery, but these figures would indicate that there is no basis for the frequent statement that this anomaly of mechanism seriously prolongs labor.

The arithmetic average of the duration of the second stage in the various groups of operative cases is more than twice as great as the duration of this stage in the spontaneous cases. Each case is given a definite test of labor before operation is considered, and this test consists of a reasonably long second stage. Realizing that a moderate prolongation of the stage of expulsion often makes possible a spontaneous delivery, the patient is given every reasonable chance to deliver herself. In the presence of a maternal or fetal indication, prompt delivery is effected, but in the normally progressing case a very conservative course has been followed, and with gratifying results.

A further analysis was made to determine, in cases of spontaneous delivery, what percentage of labors were protracted beyond the average and what the duration of the longest and shortest labors was in the various groups. The average figures given in Table 11 were employed as a basis for comparison.

TABLE 12.—SHOWING THE NUMBER OF LABORS ABOVE AND BELOW THE AVERAGE DURATION, TOGETHER WITH THE DURATION OF THE SHORTEST AND LONGEST LABORS IN EACH CLASS OF SPONTANEOUS DELIVERY.

	Primiparæ, anterior rotation.				Multiparæ, anterior rotation.			
	Labor.		2nd Stage.		Labor.		2nd Stage.	
	No.	%	No.	%	No.	%	No.	%
Above average...	73	39.25	74	39.79	85	38.64	82	37.10
Below average...	113	60.75	112	60.21	136	61.54	136	62.90
Shortest duration	2 hrs. 10 m.		10 m.		45 m.		5 m.	
Longest duration.	85 hrs. 0 m.		22 hrs. 0 m.*		90 hrs. 0 m.		4 hrs. 20 m.	

* A neglected case brought into the Hospital as a last resort.

	Primiparæ, posterior rotation.				Multiparæ, posterior rotation.			
	Labor.		2nd Stage.		Labor.		2nd Stage.	
	No.	%	No.	%	No.	%	No.	%
Above average...	12	40.0	11	36.66	10	34.49	9	31.03
Below average...	18	60.00	19	63.34	19	65.51	20	68.97
Shortest duration	4 hrs. 10 m.		15 m.		2 hrs. 15 m.		15 m.	
Longest duration.	72 hrs. 0 m.		5 hrs. 0 m.		39 hrs. 0 m.		2 hrs. 45 m.	

Approximately two-thirds of all the cases fall below the average in the various groups, indicating no general prolongation of labor or of the second stage. Moreover, the fact that only about 40 per cent of the cases rise above the arithmetic average would indicate that a true average would fall somewhat below that figure. Because of this fact an effort was made to establish a mode in the various groups of spontaneous labors, but on account of the comparatively small number of cases this was not entirely satisfactory. Table 13 indicates the results obtained by dividing the various types of labors into groups, each group representing three hours of time.

TABLE 13.—THE MODE IN THE DURATION OF SPONTANEOUS LABORS.

	Under 6 hrs.	6–9 hrs.	9–12 hrs.	12–15 hrs.	15–18 hrs.
Primiparæ, anterior rotation.....	14	24	25	**30**	19
Primiparæ, posterior rotation....	3	5	6	1	5
Multiparæ, anterior rotation.....	61	**48**	27	25	20
Multiparæ, posterior rotation.....	8	9	4	2	0

	18–21 hrs.	21–24 hrs.	24–27 hrs.	27–30 hrs.	More than 30 hrs.
Primiparæ, anterior rotation.....	19	11	11	14	19
Primiparæ, posterior rotation....	4	1	2	0	3
Multiparæ, anterior rotation.....	14	5	10	5	7
Multiparæ, posterior rotation.....	1	0	3	1	1

Table 13 well illustrates the difference between the arithmetic average and the mode, and shows how the latter indicates the probabilities in a given case much more accurately than the former. For example, the arithmetic average in primiparæ with anterior rotation and spontaneous delivery (Table 11) is 18 hours 27 minutes, and yet from Table 13 it is evident that there is a greater probability of such a labor ending after 12 to 15 hours than during any other 3-hour period, and that this period consequently more nearly constitutes an average than does any other. Likewise, in the cases of multiparæ with anterior rotation and spontaneous delivery the arithmetic average is 12 hours, whereas, disregarding the period up to 6 hours (Table 13), it is seen that more labors end in the 6- to 9-hour period, and consequently this is more nearly the correct average. In the smaller groups of cases with spontaneous labor following posterior rotation, the mode is not very clearly defined, but there is evident the same tendency for it to fall below the arithmetic average.

Table 14 illustrates the results of an attempt to find the mode in the duration of the second stage in the various types of cases. Fifteen-minute intervals have been arbitrarily chosen.

TABLE 14.—THE MODE IN THE DURATION OF THE SECOND STAGE.

	15 m. or less.	16 m. to 30 m.	31 m. to 45 m.	46 m to 1 hr.	1 hr. 1 m. to 1 hr. 15 m.
Primiparæ, anterior rotation.....	9	13	31	**35**	16
Primiparæ, posterior rotation.....	1	5	5	5	1
Multiparæ, anterior rotation.....	49	**59**	29	31	13
Multiparæ, posterior rotation.....	5	4	6	5	..

	1 hr. 16 m. to 1 hr. 30 m.	1 hr. 31 m. to 1 hr. 45 m.	1 hr. 46 m. to 2 hr.	2 hr. 1 m. to 2 hr. 15 m.	Over 2 hr. 15 m.
Primiparæ, anterior rotation.....	22	14	19	8	19
Primiparæ, posterior rotation.....	2	2	4	1	4
Multiparæ, Anterior rotation.....	13	9	5	3	10
Multiparæ, posterior rotation.....	2	1	1	1	4

Here again the value of the mode as evidencing possibilities is brought out. In the primiparæ with spontaneous delivery following anterior rotation, the arithmetic average for the duration of the second stage is 1 hour 29 minutes, whereas the mode (Table 14) falls in the period between 46 minutes and 1 hour. Also, in the multiparæ with anterior rotation and spontaneous delivery, the mode falls between 16 and 30 minutes, whereas the arithmetic average is 50 minutes. In the other two classes the number of cases is too small for the satisfactory determination of the mode, but the general tendency for it to be below the arithmetic average is to be noted.

Type of Pelvis.—In an attempt to determine whether any particular type of pelvis is more apt to produce the occiput-posterior positions, the incidence of the various varieties of

pelvic deformity in the present series was determined and compared with the figures recently published by Thoms for a series of 4000 unselected consecutive cases from the Johns Hopkins Hospital:

TABLE 15.—INCIDENCE OF VARIOUS TYPES OF CONTRACTED PELVIS.

	In Present Series. 635 Cases.		In Thoms' Series. 4000 Cases.	
	No.	Per Cent.	No.	Per Cent.
Generally contracted	66	10.39	391	9.77
Simple flat	14	2.20	59	1.47
Typical funnel	36	5.67	211	5.27
Generally contracted funnel	15	2.36	87	2.17
Rachitic	26	4.09	186	4.65
	157	24.71	934	23.33

It is seen that the frequency of the various types of contracted pelves in the cases with occiput posterior is within 1.0 per cent of the frequency observed in the larger series of unselected cases. This indicates that the character of the pelvis has no influence upon the production of these positions.

Size of the Children.—All the cases of definite occiput posterior were used for the study, irrespective of the size of the child. For the sake of completeness, the following table is introduced to show the weights of the children in the series:

TABLE 16.—WEIGHTS OF THE CHILDREN IN THE SERIES.

1000 g. or under	4
1001 to 1500 g.	8
1501 to 2000 g.	13
2001 to 2500 g.	46
2501 to 4000 g.	504
4001 g. and over	54
Weight not recorded	6
	635

The only bearing that the size of the child seems to have is that, as has already been mentioned, in the case of small children the occiput tends to rotate into the hollow of the sacrum.

Maternal Morbidity and Mortality.—Our morbidity statistics are based upon a standard of 38° C. (100.4° F.), the temperature being taken by the mouth every four hours, day and night, for nine days, and then twice daily (8.00 a. m. and 8.00 p. m.) for the next five days. Special conditions may make advisable the taking of the temperature more frequently, but it is never taken less frequently. Only a single elevation above the standard is needed to have the case classed as febrile. No elevations after the 14th day are included, as they very rarely can be attributed to the labor. The following table shows the findings as regards morbidity:

TABLE 17.—MORBIDITY.

Total cases with temperature 100.4° F. or above at any time	233	36.7%
Single initial rises (normal 24 hrs. after delivery)	37	5.8%
Other single rises (elevated less than 24 hrs.)	66	10.4%
Probable uterine infections	105	16.5%
Various other causes (eclampsia, pneumonia, mastitis, etc.)	25	4.0%

The term "single initial rise" refers to that temporary rise of temperature which so frequently occurs after a normal labor and which disappears within 24 hours, not to recur. The single rises occurring later in the puerperium and persisting for less than 24 hours can not be classified etiologically. Usually there are no symptoms and no objective findings, and within 24 hours or less the elevation has disappeared. It seems permissible to say that they are not due to a local infection of the generative tract. The 105 cases, grouped as "probable uterine infections," include all the cases which showed more than a single rise and in which a definite cause for the elevation could not be located elsewhere. That they were essentially very mild in character is indicated by the fact that there were no deaths attributable to infection. Many cases were put in this class, even when a uterine culture had failed to give any evidence of an infection, but since they could not clinically be placed elsewhere, they are included here, on the theory that a temperature elevation during the puerperium means infection of the generative tract, unless some other cause can be found.

There were in all 10 deaths in the series, a percentage of 1.57, but none of them can be attributed to the position, as the list below will show. It was not to be expected that there would not be any mortality connected with these cases.

TABLE 18.—CAUSES OF MATERNAL DEATHS.

No. 1177. Died two hours after spontaneous delivery. Chronic nephritis with convulsions.

No. 1297. Died a few hours after delivery from internal hemorrhage due to incomplete rupture of the uterus caused by manual dilatation of the cervix in the presence of a complete placenta prævia.

No. 2229. Died on the second day from toxemia and myocarditis. Confirmed by autopsy.

No. 3287. Died on the second day from acute lobar pneumonia. Confirmed by autopsy.

No. 3928. Died three days after delivery. Eclampsia. Confirmed by autopsy.

No. 5043. Died a few hours after delivery. Eclampsia.

No. 5237. Died less than 24 hours after admission. Eclampsia.

No. 5736. Died two hours after delivery. Diabetic coma.

No. 5863. Died two hours after delivery. Eclampsia. Confirmed by autopsy.

No. 5911. Died five days after Cæsarean section for partial placenta prævia and grave chronic nephritis in a 40-year-old primipara. The autopsy showed chronic diffuse nephritis.

HISTORY AND DISCUSSION.

Introduction.—It is only within the last century that the ancient fanciful descriptions of the position of the fetus *in utero* and during birth have been generally discarded. Until 1742, when Sir Fielding Ould stated that the occiput was usually turned toward one side of the pelvis during the early stages of labor, it was taught that the fetus descended through the pelvis in the position in which it was finally born, that is, usually with the occiput directly anterior under the symphysis pubis. Ould incorrectly stated that the head was turned so that the chin rested on the shoulder, but in 1752 Smellie corrected this and asserted that the trunk and head retain their usual relations, and that there is no twisting of the neck. In

1771 Saxtorph and Solayres, independently, advanced the view that the head usually enters the pelvis in the right oblique diameter.

Baudelocque, the famous pupil of Solayres de Renhac, recognized six varieties of vertex presentations, the usual four oblique and two antero-posterior. Up to that time, engagement with the occiput directly anterior was generally thought to be the most common; but Baudelocque insisted that it was very rare. He said: "It has appeared to me that the proportion of the first (L. O. A.) to the second (R. O. A.) is as 7 or 8 to 1, and to the fourth (R. O. P.) and fifth (L. O. P) as 80 or even 100 to 1; as to the third (O. A.) and the sixth (O. P.), they are excessively rare; although most accoucheurs have thought, and still think, that the third (O. A.) is the most natural and usual."

Naegele was the first to insist upon the frequency of occiput posterior positions and their eventual rotation to the symphysis pubis. His predecessors had recognized these positions, but had thought that they were not only very rare, but that the usual outcome was rotation to the hollow of the sacrum. He showed the incorrectness of these views and attempted the first objective description of the mechanism of labor. Most of the results of his careful work have stood the test of time, but his views on the mechanism of internal rotation have from time to time been assailed. Naegele's work really marks the beginning of our modern conceptions of the mechanism of labor.

Frequency.—The figures adduced by various authors with regard to the frequency of occipito-posterior positions vary so much that it is impossible to arrive at any very definite conclusions from the literature. The older authors, as might be expected, had very divergent views concerning the relative frequency of the various varieties of vertex presentations. Thus Naegele found 29 per cent of his vertex cases in R. O. P.; whereas Madame La Chapelle found only .0777 per cent and Madame Boivin .05 per cent. Simpson noted 22.7 per cent, and Swayne 1.04 per cent. The figures for the incidence of L. O. P. also varied markedly; thus, Naegele noted only .03 per cent, while Simpson had .60 per cent, and Swayne reported 2.79 per cent.

More recent writers have reported somewhat more comparable figures, but the percentages still vary considerably. Thus, Darbyshire found 16.0 per cent occiput posteriors in 276 vertex cases; Geddes had an incidence of 10.5 per cent in multiparæ and 20.8 in primiparæ. Botkowskaia reported an incidence of 18.5 per cent, and Ingraham one of 12.03 per cent. The last author states that Pinard observed 49.8 per cent and P. Dubois 26.33 per cent. Dimitroff, in 1056 vertex presentations, noted 29.54 per cent, 26.23 per cent in R. O. P., and 3.31 per cent in L. O. P., and quoted the following figures:

	R. O. P.	L. O. P.
P. Dubois	25.60%	0.63%
Pinard and Battaillard	26.70%	10.47%
Herrgott and Vallois	33.50%	0.45%
Corbière	26.22%	7.95%
Sentex	2.03%	0.95%

Several authors (Darbyshire, Geddes and Massini) state that occiput posterior is more common in primiparæ than in multiparæ.

The actual frequency of the obliquely posterior position of the occiput is especially hard to determine because of two factors. In the first place, there is a difference of opinion with regard to the status of the transverse positions of the occiput, and in the second place, with regard to the occurrence of R. O. A. as an original position.

Most authors do not recognize the transverse position of the occiput as an original engagement, but rather as a transitional stage in the anterior rotation of the occiput which was originally directed obliquely posterior. While it is generally admitted that, in certain forms of contracted pelvis, especially the flat varieties, engagement usually occurs with the sagittal suture directed transversely, the tendency is to consider this impossible, or at least unusual, when the pelvis is normal.

There are several objections to this view, but until transverse engagement is a generally admitted fact, it will be wise to disregard the possibility of its occurrence in any but contracted pelves. The first objection is the undoubted occurrence of transverse positions in normal pelves, while the head is still too high to have been affected by the factors that are usually advanced to explain internal rotation. Various abdominal and high pelvic structures have been brought forward as factors in the mechanism of rotation, but they have generally been discarded, and rotation is usually considered as occurring low in the pelvis. If it is admitted that the sagittal suture is sometimes transverse while the head is at the brim, we must either believe in high rotation or original transverse engagement, and the latter idea seems the more tenable.

A second objection was discovered in our statistics. Our figures show that the transverse positions are more frequent than the posteriors and the L. O. T.'s are more common than the R. O. T.'s. R. O. P. is generally believed to be much more common than L. O. P., and yet the relative frequency of the supposed transitional transverse positions is reversed and a combination of the posterior varieties with the transverse gives the same total for both the right and left positions.

Among the statistics reviewed, those of Voorhees alone contain any reference to transverse positions of the occiput, and he found very much the same figures as those reported here.

If we had added the transverse positions (21.75 per cent) to the posteriors (11.57 per cent), we could have reported an incidence of 33.32 per cent, which would more nearly agree with the figures reported by the majority of writers and with the general teaching; but in the presence of the two objections raised above, it was determined to disregard the transverse positions in this study and to consider only those in which actual posterior positions were first seen.

With regard to the status of the R. O. A. positions, very much the same difficulty appears. Naegele and those who followed him have stated that R. O. A. is an exceedingly rare primary position, and that the vast majority of the cases in which this position is diagnosed are seen late in labor after there has been partial rotation from an original R. O. P. We noted this position in 19.06 per cent of our vertex presentations, and here again find it difficult to consider them all as

representing merely a stage in the mechanism of internal rotation. The chief objection to the view that they are transitional in character is their undoubted presence high in the pelvis early in labor and the inability to explain this except by some abdominal factor which can produce partial rotation but never complete turning.

If the R. O. A.'s are added to the posteriors, we have a percentage of 30.63; but in the absence of direct evidence to show that the former are not primary, they were not considered in this study. It is quite obvious that, if both the transverse and the right anterior positions were added to the posteriors, the incidence of the latter would be 52.38 per cent, or more than half of the vertex positions. It is certainly not a fact that the occipito-posterior positions are as common as this, and yet very good authority could be brought forward to show why both of these additions should be made.

If, in our series, all the right positions are added together, we have 35.91 per cent, and the left positions total 63.77 per cent. Thus:

Right.		Left.	
R. O. A.	19.06%	L. O. A.	47.61%
R. O. T.	8.89%	L. O. T.	12.86%
R. O. P.	7.96%	L. O. P.	3.30%
Total	35.91%	Total	63.77%

These figures agree closely with the usual statement that left positions occur in 70 per cent of all vertex cases and right positions in 30 per cent. The proper division into varieties is in a confused state, however, and more study is needed to settle some doubtful points concerning the mechanism of labor and the possibilities of engagement and rotation of the fetal head.

Many of the variations in the percentages reported for the posterior positions undoubtedly are to be explained by the fact that the various authors have assumed that either the transverse or the right anterior positions represent transitional stages in the mechanism of originally obliquely posterior positions, or, on the other hand, as has been done in this study, have disregarded all the cases that did not have an actual posterior position when first seen.

Internal Rotation.—The frequency with which rotation into the hollow of the sacrum has been noted is of considerable importance; and the following figures have been gathered from the literature:

	Percentage.		Percentage.
Naegele	3.12	Halsey	2.00
Edgar	4.00	Harrar	14.00 (computed)
Massini	4.00	Dupre	4.00
Tweedy	4.10	Dimitroff	1.28
Mosher	2.00-7.00	Bataillard	1.61
Ingraham	7.00	Corbière	2.71

That we found such a high percentage of cases in which the occiput rotated posteriorly may be explained by the fact that in our service operative interference is postponed as long as possible, and therefore every chance is given for spontaneous rotation in one direction or the other. Our figures (14.2 per cent) would indicate that this anomaly is somewhat more common that it is usually considered to be.

In some studies, persistent occiput posteriors (obliquely and in the hollow of the sacrum) have been noted, and it is interesting to see how the results vary. Harrar says that 20 per cent remain posterior. Stark gives 50 per cent, whereas Voorhees found 104 such cases in 5000 deliveries, approximately 10 per cent, if vertex presentations are reckoned at 95 per cent and occiput posteriors as 20 per cent of these. Bill says that 50 per cent fail to rotate, and Rice noted 162 failures in 400 cases of occiput posterior, or 40.5 per cent.

By reference to Table 3, it is evident that there were 157 cases out of 576 in which the occiput failed to rotate, *i. e.*, stayed transverse or obliquely posterior, or rotated into the hollow of the sacrum. This would give us a percentage of 27.25 of so-called persistent occiput posteriors. This is a very considerable number, but it must be remembered that in nearly half of these cases the occiput rotated into the hollow of the sacrum, and this was followed in a large majority (88.6 per cent) of the cases by spontaneous delivery. If the term "persistent occiput posterior" be used only in referring to those cases in which the occiput rotates neither to the symphysis nor to the sacrum, we can very readily realize their importance, for internal rotation is one of the cardinal movements in the mechanism of labor and under ordinary conditions delivery can very rarely occur without it.

The Mechanism of Internal Rotation.—It was found, as previously stated, that the parity of the patient and the condition of the pelvic floor have no influence upon the occurrence of posterior rotation, but that the three factors which apparently do play a part are the type of the bony pelvic outlet, the flexion of the head, and its size.

An attempt was made to correlate these observations with some one of the theories of internal rotation that have been advanced. From the fact that anterior rotation is as common in multiparæ as in primiparæ, it may be argued that the muscular and fascial pelvic floor plays a minimal part in the mechanism. It is conceivable that these soft pelvic structures may act to accelerate or complete a rotation already begun, but it is impossible to make this theory of Veit explain all the vagaries of rotation under the conditions which we have observed. It is very difficult to conceive a mechanism whereby the pelvic floor alone can cause anterior rotation from an occiput obliquely posterior position. On the other hand, although the failure of this usual occurrence can be explained when the head is poorly flexed or small, these explanations do not cover those cases in which a narrow pubic arch is apparently responsible for the lack of anterior rotation.

Sellheim's otherwise attractive theory falls short when he attempts to explain posterior rotation. He assumes a spastic condition of the child's neck, which makes it more readily bent backward than forward, so that, as a consequence, the occiput turns into the hollow of the sacrum. It is difficult to substantiate this by clinical observation, and the unprejudiced obstetrician cannot detect any difference in tone in the neck musculature of children born by this anomalous mechanism. Moreover, this theory offers no explanation for the more frequent occurrence of posterior rotation in those conditions which, as we have shown, conduce to its appearance.

The various abdominal and high pelvic theories offer no assistance. In view of the fact that they have been so generally discarded, they need not be discussed here in detail.

Although none of the theories will explain absolutely all cases, Hodge's idea of the inclined planes and ischial spines will at least explain anterior rotation from an obliquely posterior position and also the phenomenon of posterior rotation in the three conditions which, according to our experience, most conduce to this anomaly. Hodge says: "Hence, when the head descends in the fourth position (R. O. P.), if the point of the occiput should strike upon the spinous process of the ischium or extreme boundary of the anterior inclined plane, it will be reflected anteriorly toward the arch of the pubis, and delivery will be effected as in an original second position (R. O. A.). If, however, the point of the occiput should strike posteriorly to the spines of the ischium, it will be reflected backward to the hollow of the sacrum." In this connection it is interesting to note that Baudelocque and Deventer observed that posterior rotation was more frequent when the ischial spines protruded.

Let us now attempt to determine why it is that the three conditions mentioned have such a tendency to cause posterior rotation. In the first place, when the head descends through the pelvis poorly flexed with the occiput obliquely posterior, it is evident that the occiput is somewhat nearer the sacrum than usual and the brow is well up against the symphysis. The ischial spines will impinge upon the head considerably in front of the occiput, and the brow will be influenced by the anterior planes, while the occiput is affected by the posterior planes. Under these conditions it is easy to understand why the occiput should go backward.

When the fetal head is smaller than usual or the pelvic cavity much more roomy than normal, there is a tendency for the head to advance through the most capacious part of the pelvis, where the resistance is least. This would tend to bring the occiput behind the spines and thus to cause posterior rotation. Or, the head being very small, it is conceivable that it would not impinge upon the spines at all and consequently, by a process of accommodation to the opening in the pelvic diaphragm, it would eventually rotate backward.

Finally, when there is a narrow pubic arch, the proximity of the tubera ischii prevents the head from getting well up under the symphysis and it must find a passage more than normally behind the protruding spines. This will mean that the head will strike the spines in such a manner that the occiput will meet the posterior inclined planes and will rotate to the hollow of the sacrum.

Where the pubic arch is wider than the arbitrarily chosen upper limit for funnel pelves (8 cm.), the ischial spines may still protrude somewhat more than usual and give a pelvis which, as regards the mechanism of rotation, should still be classed as funnel. This probably explains some of the cases of posterior rotation in normal pelves.

Anterior rotation can occur in a funnel pelvis if the anterior planes are sufficiently long to cause the occiput in its descent to strike upon them and be deflected anteriorly. In these cases the capacity of the posterior portion of the lower pelvic cavity is restricted, and the head is often molded considerably in order to accommodate itself between the approximated tubera.

If the posterior planes and the spines, rather than the soft pelvic tissues, are responsible for posterior rotation, this phenomenon should never occur after the head is visible. This is in accord with our observations. On the other hand, anterior rotation frequently happens after the head is crowned by the partially separated labia. The anterior planes and the spines are near enough to the vaginal orifice so that, when the vertex is visible, the widest portion of the head—the biparietal diameter—is in the region of these planes and their effect is then made evident. The position of the head at the time of internal rotation should, therefore, and does, vary not only with the length of the pubic bones, but also with the width of the pubic arch. The wider the arch, the lower the head must be before the spines and planes become effective, and the greater the possibility of visible rotation.

It is not claimed that Hodge's theory and its application in the previous paragraphs explain all the vagaries of rotation in the cases of occiput posterior, but it certainly seems to be the most attractive. In the elaboration of the theory to explain the observed facts, certain assumptions and conjectures have been indulged in which may not prove wholly acceptable. As a matter of fact, it is more than probable that no one theory will satisfy all the demands made upon it, and that the final word in the mechanism of internal rotation will embrace a skillful combination of several factors.

Rupture of the Membranes.—Although practically all writers assert that premature rupture of the membranes is more common in the posterior than in the anterior varieties of occiput presentations, very few actual statistics were found. Harrar found premature rupture 1776 times in 5496 occiput anterior cases, or 32 per cent, and in 348 out of 804 occiput posterior cases, or 43 per cent. Rice noted first stage rupture in 40 per cent of occiput anterior and in 60 per cent. of occiput posterior cases. Massini insists that premature rupture is more common among primiparæ with occipito-posterior positions than among multiparæ with the same positions. Some authors even say that premature rupture should immediately suggest occiput posterior because of the fact that it is so frequent in that position. Attempts to explain this relation have been mostly on the basis of a poor accommodation between the head and the pelvic inlet. Our figures—21.8 per cent of rupture before half dilatation of the cervix—fail to substantiate the usual opinion, and furthermore we cannot see why, theoretically, there should be any difference in the behavior of the fetal envelopes whether the occiput is anterior or posterior. If the head is well flexed when it enters the pelvis, as it undoubtedly is in the majority of cases, the same diameter engages at the superior strait and, that being the case, the fit must be the same whether the back of the child happens to be anterior or posterior.

Character of Delivery—Treatment.—Many articles have been written upon the correct course of treatment in occiput

posterior cases, and many methods have been devised for overcoming the difficulties which have been so greatly emphasized. The very diversity of these procedures is indicative of the confusion which exists in the whole subject. Several of the methods advocated are based on sound principles, but the majority have tended only to confuse a subject which is really comparatively simple.

C. D. Meigs, in speaking of these cases, said: "Beware of meddlesome midwifery and, if one is to err in these cases, better err on the side of waiting." This bit of advice is just as true now as when it was written, but the improvements in aseptic technique, by eliminating many of the former horribly fatal results, have led to haste in obstetrical work. The knowledge of when to interfere is as important as the mere technique of performing the usual forceps operations, but good judgment is much rarer than good operative ability. The profession generally seems to have been so impressed with the statement that occiput posterior positions will very frequently need operation that they do not wait to see whether the individual case will make that demand, but proceed to deliver instrumentally on the smallest provocation, and often on none whatever.

The more conservative writers have reported a small operative incidence. Thus, Naegele noted 11.8 per cent forceps deliveries, P. Dubois 7 per cent, Battaillard 10 per cent, Dupré 3.64 per cent, Botkowskaia 10.75 per cent in primiparæ and 2.5 per cent in multiparæ. Corinin gives the incidence of spontaneous labor as 96.23 per cent, Dimitroff as 93.9 per cent, Mosher as 90 per cent, and Lacrotte as 87 per cent. In these series, the figures were taken from cases which were normal in every other respect, and indicate the interference necessary in uncomplicated occiput posterior labors. In an early section we have considered 11.02 per cent of our operative deliveries as possibly due to the position.

In contrast to these figures indicating that the uncomplicated occiput posterior should *nine times out of ten* be delivered spontaneously, Bill reports that 50 per cent of his cases of occiput posterior needed forceps, and details rather incompletely 137 cases in which the double application of forceps was employed. Many of these operations were done with the head still high in the pelvis and, judging from the context, through a partially dilated cervix. Again, Lukins has recently stated: "The ideal plan of management in occiput posterior positions, provided the patient can be seen and the diagnosis made sufficiently early, is to hasten cervical dilatation by manual means and accomplish immediate version by combined internal and external manipulations."

The statements in the last paragraph illustrate what an unenviable reputation the position in question enjoys, and what radical methods are introduced in order to obviate difficulties which really do not exist. Evidence might, indeed, be introduced to show that there are physicians who seriously advocate the employment of the Cæsarean section in the absence of any other indication. In the light of our experience, it is difficult to see how such errors have arisen.

Of the many published methods of treating the complication, if there really be one, very few have any sound reason to commend them. Postural treatment, with the patient lying on the same side as the occiput or on the other side, as is variously recommended, is certainly of little value, as is attested by the lack of unanimity of opinion with regard to which side is preferable. Correcting the obliquity of the uterus by means of pads and binders seems futile. Manual rotation of the head at the superior strait and the correction of improper flexion digitally have a sound basis, but are rarely indicated. O'Brien's method of rotating the mother around the child, by fixing the latter manually, seems not only awkward, but useless, when one considers how readily the reverse can be accomplished. The double application of forceps distinctly has a place in the treatment of the unrotated occiput, but is indicated only when rotation cannot be accomplished manually. The single application of forceps with the blades reversed or reversing has no distinct field of usefulness when there are so much simpler methods that have not the obvious disadvantages of these procedures.

The chief point in the treatment is to give Nature a chance, and not to fall into the common mistake of thinking that the position itself will cause trouble. A large portion of the cases will need no assistance, and the majority of those that do demand help will offer no great difficulty. Spontaneous rotation will usually occur, but if it does not, at least 90 per cent of the heads can be rotated manually to the transverse or obliquely anterior positions and then delivered by a single application of the forceps. Podalic version is useful in certain cases, but should be reserved for those in which the indication for delivery arises while the head is still at the brim and the choice lies between high or floating forceps and version. High forceps are being more and more discarded as operators realize the excessive fetal mortality usually consequent upon the procedure. Rarely does the posterior position of the occiput itself call for interference while the head is still at the brim, and the exercise of a little more patience will usually be rewarded by its descent and eventual anterior rotation. Cæsarean section distinctly has no place in the treatment, unless there is some other definite indication, such as contracted pelvis, and then the occiput posterior is not what demands the section.

As has already been stated, we view these cases with equanimity, and, in consequence, the patient is treated exactly as if there was any other uncomplicated vertex presentation. We do not insist that she assume any particular position, nor do we attempt to apply any abdominal pads or binders. No attempt is made to correct improper flexion or to rotate the occiput forward. The spontaneous cases are, of course, simple: if the occiput has rotated into the hollow of the sacrum, it is permitted to be born as such. There is probably, in these latter cases, a greater possibility of perineal lacerations, but these are never extensive enough to be of serious moment. In applying forceps a certain routine is followed. In the first place, the vulva and vagina are manually dilated until they admit the clenched hand; a cephalic application of forceps is then made, the posterior blade being introduced first over the posterior ear with the hand in the vagina definitely feeling

the ear; the other blade being introduced posteriorly and rotated over the face to lock with the first. The patient is allowed to come partially out of the anesthetic while short intermittent but frequent tractions are made. If the occiput is directly anterior or posterior, a pelvic (of course, also, a cephalic) application is made and the head delivered directly. If the occiput is obliquely anterior or transverse, a cephalic application is made, and during the tractions a slight rotary movement of the blades accelerates rotation. With the occiput still obliquely posterior, the hand in the vagina grasps the head securely between the four fingers and the thumb, and rotation is attempted, the occiput being turned as far anterior as possible. The position of the head is immaterial, for this procedure can be successfully carried out even when the head is tight against the perineum. During the maneuver the head may be pushed up slightly, but this is rarely a disadvantage In rather rare cases the head will not remain in its new position and falls back to the obliquely posterior position. Here one can attempt the double application with little better chance of success, or deliberately apply as for the opposite anterior position and rotate through 45° so that the occiput becomes directly posterior. Although this procedure cannot be very warmly recommended, it has a certain field of usefulness, especially in the class of cases just mentioned and in others, particularly in patients with relaxed outlets, where haste is imperative. The Scanzonian or double application of forceps is rarely necessary. The blades are first applied for the opposite anterior position and the occiput rotated forward to a transverse or an obliquely anterior position while downward traction is employed. The blades are then removed and reapplied for the new position, and delivery is completed with the occiput under the symphysis.

Infant Mortality.—In the various statistical reports that have been published, the infant mortality in the cases of occiput posterior has received considerable attention, and the general opinion seems to be that the percentage should be little, if any, higher than for other positions of the vertex. Usually the figures given represent the deaths during labor and during the first week or two of life.

Harrar gives the total infant mortality in the occiput posterior cases, including the first few days of life, as 9 per cent, Dimitroff found 7.64 per cent, Darbyshire, 15.9 per cent, and Mosher says that the mortality is raised from the usual 4 per cent in occiput anterior positions to 10 per cent, when the occiput is posterior. Edgar gives the mortality as 10 per cent, and Ingraham as 5 per cent. Our figures, 8.17 per cent, represent about the average in the other series. Our material includes about 40 per cent of colored patients, and the infant mortality among their children is always considerably higher than among the whites.

In considering the average mortality for all cases, irrespective of position, Harrar gives 5.8 per cent and Tweedy, 7.4 per cent. The figures reecntly published from long series of cases from the Sloane Hospital for Women and from the Johns Hopkins Hospital indicate a total infant mortality, during the last two months of pregnancy and the first two weeks of extra-uterine life, of approximately 7 per cent. This is only about 1 per cent lower than our findings in the occiput posteriors, and a difference as small as this needs no explanation. For practical purposes, then, it can be said that the infant death-rate should not be appreciably increased when the occiput is posterior.

In our series 2.83 per cent of the mature children succumbed to delivery, there being no complications which would place the infant life in jeopardy. Only 5 of the 16 babies which make up this group were delivered spontaneously, so that less than 1 per cent represents the mortality if operative measures are not required. This emphasizes the fact that the mortality is chiefly due to the measures which are employed as treatment, and, consequently, the more conservative the methods, the lower the mortality rate.

Duration of Labor.—The statement frequently made that labor is very much prolonged in the cases of occiput posterior is not only not borne out by our findings, but the figures gathered from other statistical studies would indicate that there is, at most, only a very slight increase. Thus, we have gathered from the literature the following statements of the duration of labor when the occiput is posterior:

TABLE 21.—DURATION OF LABOR.

	Primiparæ.		Multiparæ.	
Author.	Labor.	2nd Stage.	Labor.	2nd Stage.
Corinin	14.07	2.14	7.56	.35 to .45
Sentex	16.00	....	16.00	....
Bataillard	14.22	....	7.50	....
Corbière	16.12	....	9.42	....
Dimitroff	16.11	....	7.41	....
Botkowskaia	21.30	....	13.30	....
Varnier	13.30	....	7.30	....
Rice	16.30	2.10	11.30	1.40
Massini	11.15	....	8.12	....

Harrar says that the average duration of labor in primiparæ and multiparæ is 16 hours, and of the second stage 1 hour and 35 minutes.

It would not be surprising if labor were somewhat prolonged, especially when it is considered that rotation takes place through an arc of 135° rather than through 45°; and that when the occiput rotates posteriorly the dilatation of the outlet by a larger diameter of the head would tend to prolong labor. Williams gives the average duration of labor in primiparæ as 18 hours and of the second stage as 1 hour and 45 minutes, and his figures for multiparæ are 12 hours and 1 hour respectively. Our figures (Table 11) correspond so closely with these that it cannot be said that there is any definite prolongation due to the position.

Although it would seem that the adaptation of the principle of the mode to statistics of this kind would serve a distinct purpose in indicating more accurately the probabilities with regard to the duration of labor in any given case, yet it apparently has not been applied and there are no figures available for comparison.

Type of Pelvis.—The type of pelvis has rarely been noted in the other statistical studies, except that some of the series

have been taken from cases with normal pelves alone. Harrar found a "small pelvis" in 3 per cent of his cases of occiput posterior, and states that the outlet was "moderately contracted" in 22 per cent and "small" in 1 per cent. Ingraham found a slightly increased frequency of occiput posterior positions in women with contracted pelves. Paramore states that the "small round pelvis" causes persistent occiput posteriors, and quotes Edgar as saying the same thing for a kyphotic pelvis observed by him. In the latter case, the funnel shape of the pelvis can be adduced as the cause of the lack of rotation rather than the inlet contraction, if one existed. There are no available statistics which would indicate that any one type of pelvis is especially a factor in the production of occiput posteriors. Our figures show no relation between the incidence of any type of pelvis and posterior-occiput positions. It is probable that the position of the occiput is determined solely by other factors.

Maternal Morbidity and Mortality.—A comparison of morbidity rates is always unsatisfactory because of the variations in the routine for temperature taking. It is obviously unfair to compare twice daily temperature observations with those taken every four hours, and, likewise, axillary or rectal temperatures with those taken by mouth. For that reason only the observations on other groups of cases from the same clinic are comparable, in that all the conditions are the same. The author has recently reported in an entirely different connection a series of 400 consecutive cases in which the morbidity rate was 37.8 per cent. While it might seem that the rate in the present series, 36.7 per cent, is high, nevertheless it is almost identical with the other series, thus indicating no increased morbidity in occiput posteriors, which is really the point in question. The apparently high morbidity rate can be explained by the high criterion to which each case is subjected, and by the fact that all the patients are used for purposes of instruction.

As might be expected, there is no maternal mortality attributable to the position of the occiput, and the 10 deaths in the series were so definitely due to other causes that no suspicion can be directed against the occiput posteriors.

Conclusions.

1. The frequency of occiput obliquely and directly posterior positions was 11.57 per cent in the series, although the actual percentage of cases originally in this position was probably considerably higher.

2. Rotation of the occiput into the hollow of the sacrum occurred in 14 per cent of the cases.

3. Three factors which tend to favor rotation into the hollow of the sacrum are poor flexion, small size of the head, and funnel pelvis. Contraction of the pelvic inlet favors anterior rotation.

4. The etiology of internal rotation is not satisfactory, but Hodge's theory of the ischial spines and inclined planes is the most acceptable.

5. Premature rupture of the membranes was not especially frequent when the occiput was posterior.

6. Spontaneous delivery was the usual outcome. The total operative incidence was 22.9 per cent, but in only 11.02 per cent was the position possibly accountable for the need for intervention.

7. There was no increased infant mortality because of the posterior position.

8. Labor was not prolonged, independently of whether the occiput rotated to the symphysis or into the hollow of the sacrum.

9. A contracted pelvis did not increase the incidence of the posterior positions.

10. There was no additional maternal morbidity or mortality.

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A LETTER OF EDWARD JENNER CONTAINING A BRIEF ACCOUNT OF HIS DISCOVERY OF VACCINATION.*

By CHARLES M. MCBRYDE, M. D., Washington, D. C.

The communication I have to present this evening consists of a letter which was found among some old family papers. The letter was written by Edward Jenner, the discoverer of vaccination, to my great grandfather, John Bolton, who at the time was a prominent citizen of Savannah, Georgia. In the years 1802 to 1806, Mr. Bolton and his wife, who is referred to in the Jenner letter, spent some time in traveling abroad. During a visit to England in 1805, Mr. Bolton appears to have placed himself under the professional care of Dr. Jenner, who had then achieved a conspicuous place in the medical world of the day. Mr. Bolton was in London at the time he received the letter and had evidently consulted Jenner at Cheltenham at an earlier date, probably a short time previously. The first portion of the letter, that is, the letter proper, is of a purely personal nature, pointing out the probable origin of Mr. Bolton's ailment and giving rather full and explicit directions in regard to diet and exercise. The second portion of the letter, or rather the postscript, which is somewhat longer than the letter itself, and deals with the subject of Jenner's great discovery, is the part of especial interest. I shall, however, give you the whole letter, as it will doubtless be of interest to most of you to hear Dr. Jenner's advice in regard to diet and exercise and it may also be of interest to some of you to speculate on the probable nature of the complaint for which Dr. Jenner prescribes. In this connection I will state that Mr. Bolton was 31 years of age at the time. That the ailment from which he suffered was not of a serious nature is attested by the fact that he lived for 33 years thereafter, attaining the age of 63 years, but perhaps this was due to the fact that he was careful to follow out the course of life laid down for him by the "father of vaccination." The letter, while perfectly legible, is considerably worn and hardly in condition to pass among the audience. I have therefore had lantern slides made from it and will have these thrown on the screen. I will read the letter slowly and feel sure you will have no difficulty in following it on the screen.

The letter was folded and sealed with a black wafer. It is addressed to "John Bolton, Esqr., York Hotel, New Bridge Street, Black Friars, London." It is stamped "Cheltenham 10 D" and is postmarked "Sept. 26, 1805." The letter is as follows:

Cheltenham Sept. 8th 1805

My dear Sir

After maturely considering the nature of your complaints, I am strongly induced to think that all of them arise from a debilitated state of the stomach & bowels. What then is to be done to recall

* Read before a meeting of The Johns Hopkins Hospital Historical Club, March 8, 1915.

that suspended energy which is so essential not only to life itself but to that correct movement of the vital organs in general, on which the comforts of life depend? This I shall endeavor to point out. Some medicinal treatment will certainly be necessary, but this will not be so essential as the strict observance of the rules of diet; the former indeed unaided by the latter will in my opinion be of little avail. Recollect then my injunctions when at Cheltenham. To be very sparing in the use of such food as experience tells us has a tendency to become either acid or flatulent, such as Garden Vegetables in general, Fruit, Pastry, melted butter, beer & cider etc. & in their stead to live chiefly on such food as will not only afford more nutrition but give less disturbance during digestion. Of this description is animal food. You need not be very choice in your selection—past experience will point out that which agrees best with you. Exercise is very conducive to digestion, and this you will take either on foot or Horseback in a regular way. But you must avoid those exertions which will bring on any great degree of lassitude. I know nothing so likely to correct your costive habit as the artificial Cheltenham Water prepared with the chalybeated Cheltenham Salts—& nothing so proper as opium if at any time you should feel the spasm that has so long annoy'd you, in any degree of violence. Enclos'd is a Prescription for the Chalybeate I mentioned, and from its use in conjunction with the other restorative means pointed out, I expect you will derive that amelioration in the state of your health which will afford me pleasure to hear of on a future day. This medicine will keep well in a vial—you may take forty grains of it twice a day mixt with any thick substance, such as Honey, Molasses or gruel. I have also enclos'd a Prescription for Mrs Bolton, from which I trust she will derive great advantage, and if she could bring herself to relish a diet of a kind similar to that I have recommended to you, I feel confident of its proving essentially useful to her.

Believe me dear sir, with every good wish your obliged and very faithful humble servant

Edw[d] Jenner

P. S. The greater part of this letter was written when dated; but from a series of unavoidable interruptions I have be(en) driven to the necessity of not finishing it till now. I trust it will reach you before you leave England.

You were good enough to express a wish during our conversation on the subject, to be acquainted with my History as far as relates to the vaccine discovery. I will therefore give you the following outline. Pray make what discretional use of it you please, but dont publish it; at least dont print it, as I think it would dishonor my country.

Near thirty years ago, my researches into the nature of the Vaccine disease commenc'd. Although much accustomed from my earliest years to the investigation of subjects in Natural History, I found this so involv'd in obscurity, so intricate and complex that I did not develop it to my complete satisfaction till the year 1798, when, in a publication, entitled "An Inquiry into the causes and effects of the Variolæ Vaccinæ or Cowpox" I immediately laid the whole before the world. My situation at this time was that of a physician in full and lucrative practice in my native County, Glostershire. But being necessitated to quit my situation in the country and live in London in order to establish the new practice, my increas'd expenses and the separation from my former professional income reduced my possessions from a state of plenty to that state which gave me some alarm. In this situation I made an application to Parliament and was heard. £10'000 was the sum proposed by one member as a compensation and 20'000 by another. The lesser sum was voted, the minister, Mr. Addington, alleging that he should certainly have consented to a grant of the larger sum but was well convinced that my practice in town would speedily and amply remunerate me. I made the Trial and according to my own expectations, failed. It could not well be otherwise, as I had concealed nothing, but on the contrary took the greatest pains during my residence in Town to make everyone as good a Vaccine Inoculator as myself. Whereas, had I (looking forward to the amassing of Riches more than diffusing the incalculable advantages of the Discovery) kept it a secret, my Fortune might have been made to any extent. This opinion was given in evidence before the Committee of the House of Commons by some of the first medical Gentlemen in the Metropolis.

I am now again a Resident for the most part in Glostershire, and from a combination of circumstances which I need not detail am doom'd to feel the pressure of an expense of more than £500 per annum without scarcely any provision being made for me, the vote of Parliament having done little more than make up the losses and expenses incur'd in the prosecution of that Inquiry which led to the fortunate discovery and establishment of Vaccine Inoculation, a discovery which I trust I may be allowed exultingly to say will add more to the stock of human happiness than any that has preceded it. E. J.

Just a few words in closing as to why Jenner took pains to set forth these facts in regard to his discovery and why he admonished Mr. Bolton not to publish the letter. The tone of the letter shows very clearly that Jenner at this time was much dissatisfied with the grant of £10,000 awarded him by Parliament and that he regarded this sum as an inadequate reward for the time and labor he had spent in prosecuting his investigations, which, as he states in the letter, covered a period of 30 years and had placed him under heavy expense, hence his admonition not to publish the letter for fear it would reflect upon his country. This feeling of bitterness toward his country was doubtless afterward dissipated when Parliament, recognizing his just deserts, made him a second grant of £20,000 in 1807. Furthermore, at about this time his friends and admirers in other parts of the world were endeavoring to raise popular subscriptions in his behalf, in order to testify their appreciation of the value of his great discovery. Thus, in 1812, he received a subscription of £7383, which was raised in India where his discovery had been gratefully received. A similar undertaking was set on foot in France by Dr. Valentine, of Nancy, a friend and admirer of Jenner's, but this effort appears to have come to naught. It seems not improbable that Mr. Bolton may have had some plan of this sort in mind for the United States, where at this time vaccine inoculation had become well established, thanks to the efforts of Dr. Waterhouse, President Jefferson and others. The fact that Jenner prefaces the outline of his discovery with the words, "pray make what discretional use of it you please," suggests that Mr. Bolton in the course of his conversation with Jenner at Cheltenham may have indicated that he could make use of these facts in America. This is mere supposition, however, and I do not know whether any steps were ever taken looking toward a popular subscription in this country.

As far as I know Jenner's request has been respected and this letter has never been published, but in view of the fact that he finally received an adequate reward from his government and became the recipient of innumerable honors, both at home and abroad, there is certainly now no fear that this country will suffer criticism from its publication.

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My dear Sir—

After maturely considering the nature of your complaints, I am strongly inclined to think that all of them arise from a debilitated state of the stomach and bowels. What then is to be done to recall that suspended energy which is so essential not only to life itself but to that correct movement of the vital organs in general, on which the comforts of life depends? This I shall endeavor to point out. Some medicinal treatment will certainly be necessary, but this will not be so essential as the strict observance of the rules of diet; the former indeed unaided by the latter will in my opinion be of little avail. Recollect then my injunctions when at Cheltenham. To be very sparing in the use of such food as experience tells us has a tendency to become either acid or flatulent, such as Garden Vegetables in general, Tarts, Pastry, melted Butter, Beer, Cider &c. & in their stead to live chiefly on such food as will not only afford more nutrition but give less disturbance during digestion. Of this description is animal food. You need not be very choice in your selection — past experience will point out that which agrees best with you. Exercise is very conducive to digestion, and this you will take either on foot or Horseback in a regular way. But you must avoid those exertions which will bring on any great degree of lassitude. I know nothing so likely to correct your costive habit as the artificial Cheltenham Waters prepared with the Chalybeate Cheltenham salts — & nothing so proper as Opium if at any time you should feel the spasm that has so long annoyed you, in any degree of violence. Enclosed is a Prescription for the Chalybeate I mentioned, and from its use in conjunction with the other restorative means pointed out, I expect you will derive that amelioration in the state of your health which it will afford me pleasure to hear of on a future day. This Medicine will keep well in a vial — You may take forty grains of it twice a day, mixed with any thick substance, such as Honey, Molasses, or gruel. I have also enclosed a Prescription for Mrs Baltes, from which I trust she will derive great advantage, and if she could bring herself to relish a diet of plain food similar to that I have recommended to you, I feel confident of its proving especially useful to her.

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Edwd Jenner

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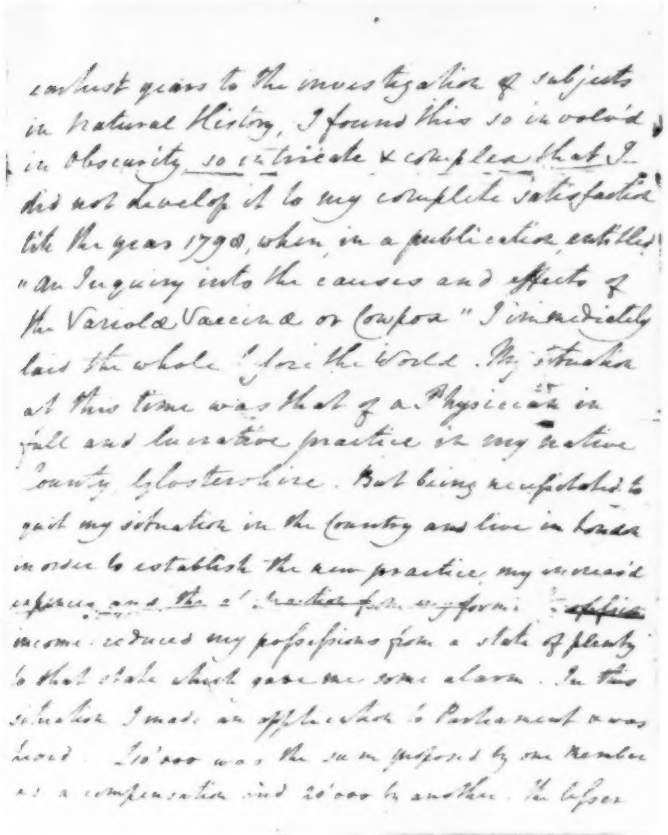
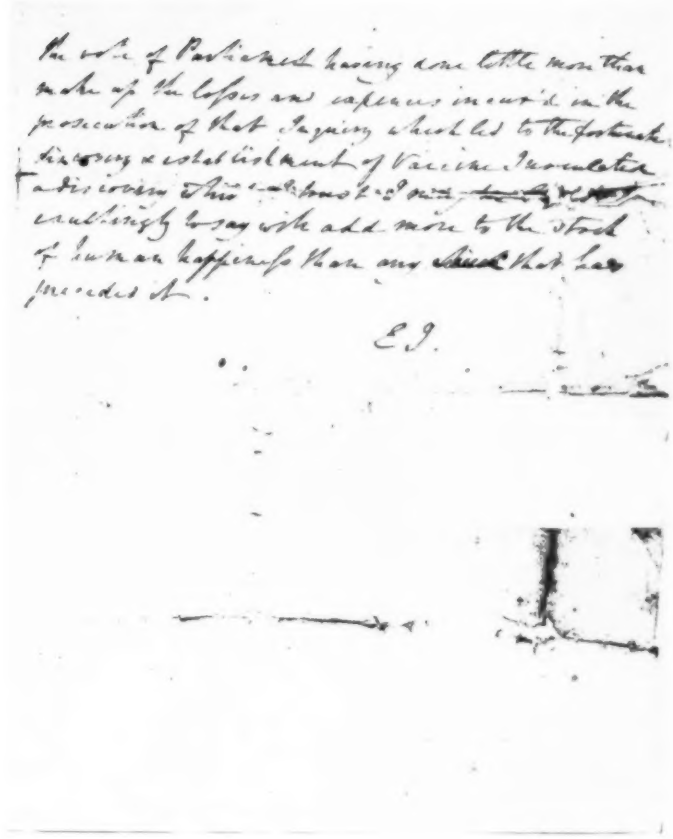


I am now called, the Minister Wm Addington alleging that it should certainly be considered concealed to a great degree if the Lancet was but was well convinced that my practice in Town would quickly and amply remunerate me. I made the trial and according to my own expectations failed. It could not well be otherwise, as I had concealed nothing, but on the contrary took the greatest pains during my residence in Town to make every one as good a Vaccinator as myself. Whereas had I (looking forward to the accomplishing of Riches more than diffusing the inestimable advantages of the Discovery) kept it a secret my Fortune might have been made to any extent. This opinion was given in evidence before the Committee of the House of Commons by some of the most eminent medical Gentlemen in the Metropolis.

I am now again a Resident for the most part in Gloucestershire, and from a combination of circumstances which I need not detail am loosing the prospect of an expence of more than £10 per annum without scarcely any provision being made for me.



the use of Parliament having done little more than make up the losses and expences incurr'd in the prosecution of that Inquiry which led to the first discovery & establishment of Vaccine Inoculation a discovery which I almost dare say will ever add more to the stock of human happiness than any that has preceded it.

E J.

A REPORT OF SIXTY-FOUR CASES OF EPILEPSY IN PATIENTS FROM FOURTEEN YEARS TO FORTY YEARS OF AGE.

By L. R. WATERS,

Social Service Department, Johns Hopkins Hospital.

From January 1, to September 1, 1915, there applied to the Neurological Dispensary of The Johns Hopkins Hospital, for treatment, 173 people who were suffering from epilepsy.

Of this number, 64 between the ages of 14 and 40 were taken at random for a social study. No effort was made to select cases which seemed especially interesting. The ages from 14 to 40 were chosen because between these limits one is supposed to be of the greatest economic value to the community. In gathering the following information, each patient was interviewed in the dispensary, then the home was visited, and interviews were held with relatives and friends, and in some cases with school-teachers and employers. From this study it was hoped to show in a small way the need of an institution for those suffering from epilepsy, where the patient could be protected, trained and studied.

As shown by the summary of the statistics gathered, in a large majority of the cases, the onset of the trouble appeared before the twelfth year. Of the 64 patients, 57 had made some attempt at an education, but 30 of these had been obliged to leave school because of their epileptic attacks. As regards the grades reached before leaving school, five got no further than the first grade, and one reached the first year of college. The greatest number for any one grade was 15 in the fourth grade. Thirty-eight attended the public schools, and 19 were in the parochial schools. Investigation has shown that the parochial schools are more willing to keep epileptic children in their classes than are the public schools. For a very short period of time the public schools had two or three special classes for epileptics, but they were soon disbanded as they were not found practical. The pupils for these classes were drawn from the entire city, and either had to have someone take them to school and call for them, or else they had to go alone. Many of them had attacks on the way to and from school; there were several accidents; for the most part parents were afraid to have their children attend these classes. Consequently, a great number suffering from epilepsy received no education at all. Even though the statistics show that many of them had reached grades in which they should have been able to read and write, investigation has proven that few of them actually read and write; nor do the parents attempt to teach them anything at home. From the time of the first attack, they are treated differently from other members of the family, and no effort is made to help them to find life pleasant in any way. To use the words most often employed in describing their life—they "just sit around."

Twelve of the 64 have married, seven men and five women. Five, two men and three women, gave as a reason for marrying that they had been told that marriage would cure them of epilepsy. All seven of the men are working and supporting their wives. Three of them have regular employment, but the other four are in constant dread of losing their work. In only one case, that of a colored man, has the wife deserted. Four of the men are fathers of healthy children. Three have no children. None of the married women work away from home. Four of the women are supported by their husbands, and one by relatives. One woman had an epileptic attack during the marriage ceremony. The ceremony was halted until her recovery and then completed. Her husband deserted her six months later, and she had to return to relatives for care. Another of the women gave birth to an illegitimate child when 15 years old, has since been divorced from one man, and is again married. She has syphilis and her mental state is poor. She is responsible for the training of her own illegitimate son of 14 years and a 10-year-old stepdaughter. Only two of the married women have given birth to children—the one mentioned above, and another who is the mother of four children, three of whom have epilepsy and the fourth lung trouble. All of the patients mentioned, both men and women, were married after epilepsy had developed.

Twenty of the 64 patients have never been able to even attempt work. Forty-four have tried everything, from errand boy to foreman in a clothing factory. In no case had there been any attempt at special training. Of the 44 who began work, only 15 persevered for any length of time. Of these 15, three have never been advanced in salary, one has been decreased, and 11 have been increased. Seventeen of the families have been registered as asking help from some local agency.

No mental test was made of any of the patients, but in only nine of the cases did the mental condition appear normal. In 17, the mental state seemed fair and in 38, poor.

In 17 of the families, there was more than one person suffering from epilepsy.

Thirty-eight of the 64 patients quite obviously need institutional care.

Almost every story heard was a tragedy. Invariably some member of the family, usually the mother, has to devote her entire time to the patient. He can never be alone, and yet there is no place for him. The schools will not have him; the public amusements do not welcome him; and he is even discouraged from going to church; so that, untrained, he necessarily must "just sit around." One mother told of her constant fears for her 16-year-old boy, a strong, good-looking lad, who could not get work but who spent his time ogling the little girls of the neighborhood. Another mother tells of having her life "wrecked" by her epileptic daughter, for whom the state makes no provision, who has already given birth to one illegitimate child, and who is entirely unmanageable.

There are many stories of families suffering privations in order that the $3 or $4 may be forthcoming each month to buy the patent medicine which is guaranteed to cure "fits."

A similar story is told by a mother who has spent all of her savings, several thousand dollars, to keep her son in a private sanatorium which professes to cure epilepsy. One sad case is of a young woman who had been entirely self-supporting until five years ago, when epilepsy developed. She is alone in the world, she cannot secure work, and the only haven for her is either the dreaded almshouse or a hospital for the insane. One patient has been well educated, and has held and lost many positions because of his "spells," though he has not had more than two in four years. His trouble is in some way always discovered, and employers are unwilling to employ him because of the high rate of insurance called for by the "Workmen's Compensation Act." In almost every instance there is great financial need, and the families would have a hard fight even without the added burden of the afflicted son or daughter.

Many of the people are pathetically ignorant. For instance, the mother of four epileptic children stated that some enemy had put a "spell" on her. She spent much needed money on "herb doctors" and on a "colored lady who can take spells off." Another woman, the mother of a deaf and dumb and epileptic girl, will allow her to marry "if some nice deaf and dumb man, who can understand her and sympathize with her, comes along."

The only provision now made for the care of epileptics is for a few children (I have been able to have admitted but two in one and a half years) in the Rosewood Training School for Feeble-minded Children, the state hospitals for the insane, and the Silver Cross Home which is supported by The International Order of the King's Daughters and Sons. This latter home is the only one in Maryland solely for epileptics. It receives only women and girls and can accommodate but 25. I have been unable to secure a single admission there since January, 1914.

In order to send a patient to a state hospital, he must be examined and declared insane by two physicians. A large percentage of epileptics are not insane, and their families object to having them sent to state hospitals for the insane.

Maryland could fill to overflowing in a short time any good colony planned for epileptics. If there are 173 cases in one clinic of our dispensary, think of the number there must be throughout the city and the state, who are being treated at other dispensaries and by private physicians!

SUMMARY OF A REPORT OF SIXTY-FOUR CASES OF EPILEPSY IN PATIENTS FROM FOURTEEN YEARS TO FORTY YEARS OF AGE.

			Age.			Married.	Unmarried.
			14 to 20.	20 to 30.	30 to 40.		
Number of white	Males	31	13	15	3	6	25
	Females	28	8	12	8	5	23
Number of colored	Males	3	1	1	1	1	2
	Females	2	2	..	..	..	2
		64	24	28	12	12	52

Age at Onset.

Under 12 years	41
From 12 to 20 years	21
Over 20 years	2
	64

Work Record.

Have never worked	20
Have tried everything from errand boy to foreman in clothing shop	44
	64
Of the 44 who started work:	
Gave up after a very short time	29
Remained at work	15
	44

Education.

Number attending public schools	38
Number attending parochial schools	19
Number never in school	7
	64

Grade Reached Before Leaving School.

Left in first grade	5
" " second grade	1
" " third grade	5
" " fourth grade	15
" " fifth grade	8
" " sixth grade	9
" " seventh grade	7
" " eighth grade	5
" " first year of college	1
Unclassified	1
	57

Reasons for Leaving School.

Because of "spells"	30
To work	27
	57

Salary Record of the Fifteen Who Remained at Work.

	Wage per week at beginning.	Wage per week at present time.	
1	$2.50	$6.00	Increase 11
1	3.50	12.00	
1	3.50	12.00	
1	3.50	15.00	
1	3.50	8.50	
1	4.25	10.00	
1	1.25	6.00	
1	2.50	10.00	
1	2.50	9.00	
1	3.00	10.00	
1	1.50	11.00	
1	2.50	1.50	Decrease 1
1	4.00	4.00	Same 3
1	3.50	3.50	
1	3.50	3.50	

Mental State.

Very poor	38
Fair	17
Apparently normal	9
	64
Plainly institutional cases	38
Have had to ask help of some registered social agency	17

SEVERE ANEMIA WITH EOSINOPHILIA.*

By ARTHUR F. BEIFELD, M. D.,

AND

MILFORD E. BARNES, M. D., Chicago.

The facts pertinent to a discussion of the case forming the basis of this report are briefly as follows: The patient, a German of 68 years, entered the County Hospital, Chicago, November 27, 1915. His request upon admission was to be relieved of body vermin and to be given shelter. The noteworthy feature of the physical examination was the high-grade pediculosis corporis with its typically located scratch marks. The skin, especially of the trunk and extremities, was of a dark brown color, while in texture it was thick and harsh, suggesting an eczematous change superimposed upon the parasitic. The case was characteristically one of vagabond's disease. Contrasting with the blackish-brown pigmentation of the trunk were the lemon-yellow color of the face and the pallor of the visible mucous membranes.

A marked pulmonary emphysema with the usual associated findings was also present. Pulse, temperature and respirations were approximately normal while the patient was under observation. The systolic blood-pressure registered 110 mm., the diastolic 68. The ophthalmological examination presented no abnormalities aside from a bilateral cataract. The subcutaneous tissue was fairly well preserved. Asthenia, however, was marked and of a degree to keep the man confined to his bed throughout his stay in the institution. The nervous system showed no anomalies except a questionable Babinski phenomenon on the left side.

The cerebrospinal fluid exhibited a normal cellular content and negative globulin and Wassermann reactions. The latter was also negative in the blood. The urine on one examination contained a small amount of albumin but no casts, and on another no albumin but a few hyalin and granular casts. Blood cultures remained sterile.

A progressive weakness marked the course of the condition, exitus occurring January 28, 1916, just two months from the date of entrance. The final days of the illness revealed no new symptoms, death being due evidently to the asthenia.

The hematological findings are summarized in the following table.

	Nov. 27, 1915.	Nov. 29, 1915.	Dec. 8, 1915.	Dec. 20, 1915.	Jan. 11, 1916.
Erythrocytes	1,667,000	.....	1,670,000	1,440,000	1,600,000
Hemoglobin	46 (Dare).	.....	46 (Sahli).	28 (Sahli).	42 (Sahli)
Color Index	1.4—	.....	1.4	1.0—	1.3+
*Macrocytosis	++	.....	++	++	++
Microcytosis	+	.....	+	+	+
Poikilocytosis	++	.....	++	++	++
Polychromasia	+	.....	+	+	+
Basophilic Gran	+	.....	+	+	+
Megaloblasts	1 per 100 white cells.	.....	2 per 100 white cells.	1 per 100 white cells.	0
Normoblasts	0	.....	0	0	0
Leucocytes	5500	.....	5500	4200	5000
Polynuclear Neut	34%	20%	36%	34%	10%
Lymphocytes	13%	10%	19%	51%	55%
Large Mononuclears and Transitionals	5%	11%	0%	1.5%	0%
Eosinophiles	47%	59%	43%	9%	28%
Basophiles	1%	0%	0%	0.5%	1%
Myelocytes	0%	0%	1%	1%	0%
Myeloblasts	0%	0%	1%	2.5%	0%
Irritation Forms	0%	0%	0%	0.5%	0%
Platelets	Practically absent.			Much diminished.	

*Many gigantocytes.

The identity of the eosinophiles was unmistakable. The majority were of the size of a polymorphonuclear neutrophilic leucocyte, the remainder being somewhat larger. The nuclei, consisting generally of two round or oval segments united by a delicate chromatin bridge, did not stain as deeply as did those of the polynuclears. The large round granules, which in the fresh specimen stood out as highly refractile bodies, in the stained preparation varied in color from an almost crimson red through a pale red to a bluish red. While some of these cells were compactly filled with the granules, others contained fewer, and still others showed clear round spaces formerly occupied by the acidophilic bodies.

The erythrocytic side of the blood-picture is embryonal, such as is characteristically met with in pernicious anemia. Thus, indicative of this type of erythropoiesis, are the many abnormally large cells, the high color-index and the presence of megaloblasts (without normoblasts). The leucocytic torpidity which constitutes so integral a feature of pernicious anemia —except in the remissions and in the presence of complicating infections—is evidenced here by the leucopenia and the relative lymphocytosis (in the later counts). The platelet diminution is also suggestive.

Utterly inconsistent, however, with pernicious anemia is the enormous eosinophilia. The following data may be cited relative to this point: Cabot,[1] in 52 cases, in which a total of 78 examinations were made, found an average eosinophilic count of 2.7 per cent. His highest figures were 9 per cent in one case and 6.6 per cent in another. Da Costa[2] obtained an average of 1.68 per cent in 31 cases, the highest counts being 5.2 per cent, 7.2 per cent and 8 per cent. In a collection of 1200 cases gathered from American and foreign sources, Cabot[3] noted that the eosinophilic percentage was usually normal. In 83 out of 380 cases, however, it was above 7 per cent at some time during the course of the disease. Further, according to the same observer, the cells in question are subject to rather marked and rapid numerical variations from causes unknown.

Naegeli,[4] Grawitz,[5] Ehrlich and Lazarus[6]—in fact, hematologists generally—record similar observations, *i. e.*, that the eosinophilic white cells are usually not far from the normal relatively, though often they are reduced and not infrequently absent altogether in the periods of greatest marrow exhaustion. A persistent leukopoietic myeloid overactivity—polynuclear

* Read before the Chicago Society of Internal Medicine, January 24, 1916.

leucocytosis, myelocytosis, eosinophilia—is entirely at variance with the present-day conception of the nature of pernicious anemia.

The blood-picture of the essential, Addison-Biermer, type of pernicious anemia is indistinguishable from that produced by three known causes—helminthiasis, notably dibothriocephalus latus, syphilis and pregnancy. The possibility of the presence of an intestinal parasite was especially to be considered in this case because of the eosinophilia, though it is generally conceded that when the blood approaches the pernicious picture these cells behave as they do in the idiopathic form. Repeated examinations of the stools for ova, with employment of the Yaoita[7] antiformin method for rendering them more accessible, were uniformly negative. The negative Wassermann reaction both in the blood and cerebrospinal fluid made the presence of lues improbable. Trichiniasis, it may be noted parenthetically, entered into the differential diagnosis only as a possible cause of the eosiniphilia, but not of the embryonal type of anemia; and a section of muscle from the biceps tendon revealed no trichinellæ.

There is another group of conditions which may produce a blood-picture similar in most respects to that of the Addison-Biermer type. These are the so-called secondary forms of pernicious anemia. It is not within the province of this paper to enter into the still unsettled question as to whether the idiopathic form exhibits hematological features by means of which it can generally be distinguished from the cases of known etiology. Be this as it may, the two are not infrequently difficult of differentiation. Malignancy, especially carcinoma of the stomach, hepatic affections, ulcerative endocarditis, inanition due to severe digestive disturbances, nephritis, chronic malaria, lead-poisoning, tumors of the bone-marrow, hemolytic icterus—these are the principal causes of severe anemias resembling the essential pernicious form.

Neither the anamnesis nor the physical or laboratory findings in the case furnished even a plausible basis for the diagnosis of any of the above-mentioned conditions. However, the relationship of malignancy to eosinophilia and of gastric carcinoma to pernicious-like blood-pictures made the study of the stomach especially interesting. Motility was good; in fact, as shown by the fluoroscopic examination, the pylorus was abnormally patent, allowing the barium meal to hurry through the organ. This we attributed to the associated achlorhydria, which often, as is well known, tends to produce an atonic pyloric sphincter. The Ewald meal, removed in an hour, yielded 100 cc. The X-ray plates showed no incompleteness of the gastric contour indicative of ulceration. Neither the stomach-contents nor the stools contained blood.

The essence of the case resides in the difficulty of reconciling the enormous eosinophilia with the leucocytic torpor (leucopenia, lymphocytosis), on the one hand, and with the blood-picture of pernicious anemia on the other. Two common causes of an increase in the acidophilic cells, though ordinarily associated with a normal total white-corpuscle count, are obvious, *viz.*, the pulmonary emphysema, which in this regard differs only in degree from bronchial asthma, and the dermatosis, which may cause an eosinophilia of 50 per cent or even higher. Neither of these conditions in itself, however, can be adduced in explanation of the embryonal type of anemia.

As an autopsy was not obtainable, theory must take the place of fact. The erythropoiesis is that of pernicious anemia, with which are harmonious also the leucopenia and the lymphocytosis. To explain the eosinophilia, however, if the case was actually one of pernicious anemia, one must assume either that the medullary tissues produced the eosinophilic cells in response to a selective stimulation, or that these cells were formed in extramedullary sites. In either case, the eczema (pediculosis) or the emphysema, or both, probably furnished the exciting cause of the eosinophilia.

While it is more or less generally agreed that the eosinophilic leucocytes may arise, under unusual conditions, outside of the bone marrow, there is a considerable difference of opinion as to the nature of such *histogenic foci*. Naegeli,[8] for example, believes that, if eosinophiles arise in the skin and mucous membranes—as is urged by some—they originate then only from myeloid tissue which has appeared at new points, that is, perivascularly, as in embryonic life, and that in such new areas of myeloid tissue there are always, in addition, eosinophilic myelocytes and myeloid elements other than the eosinophilic. Illustrative of this are Hoffmann's[9] findings in a case of mercurial dermatitis, in which he noted in the greatly inflamed cutis a marked dilation of the papillary and subpapillary vessels, with swelling and cloudiness of the endothelium, and a rich perivascular round-cell infiltration containing many eosinophiles. Further, in sections of the vessels of the rete, and in the exudate of the horny layer, were many eosinophiles and also some mononuclear (myelocytic) forms. On the basis of this picture, Hoffmann came to the conclusion that the skin was a workshop for eosinophiles under pathological conditions.

On the other side there are those like Dominici[10] and Weidenreich,[11] who maintain that the eosinophiles may arise locally from the tissues involved in the particular case, not from metastatic medullary foci, but from lymphocytes, without an intermediate stage such as the myelocyte. In this case the eosinophilic granules are presumed to originate from disintegrated hemoglobin, a view especially championed by Weidenreich.[12] Though these conceptions apparently have little in their favor, they harmonize well with certain conditions present in our case. Thus, the eosinophiles have been most numerous at the times when the lymphocytes were relatively few. Furthermore, as pointed out by Weidenreich, the eosinophiles are likely to be increased when there is a diminution in the erythrocytes and evidence of an augmented destruction of the red cells.

Despite our inability to obtain an autopsy in this case, it has seemed worthy of being placed on record because of its one outstanding feature, *viz.*, the association of an embryonal type of erythropoiesis, plus leucopenia and relative lymphocytosis, with an enormous eosinophilia. To reconcile the latter with

the idiopathic form of pernicious anemia one must assume either a selective—and highly anomalous—stimulation of the bone-marrow, or an extramedullary origin of the eosinophilic cells. The assumption of a secondary pernicious anemia, so-called, due in this case to an undiscovered cause, is scarcely more satisfactory, in that cases with a discoverable etiology differ in one or more particulars—normal or increased leucocyte count, post-embryonal erythropoiesis, a color-index hovering about one or even less than one, etc.—from the hematological picture tabulated above: and, furthermore, as already noted, it is generally true that in severe secondary anemias produced by conditions which likewise give rise to an eosinophilia, the latter tends to recede, the acidophilic cells progressively diminishing, as the blood-picture approaches that of the idiopathic type.

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THE POSSIBLE RÔLE OF BOOKS IN THE DISSEMINATION OF THE CONTAGIOUS DISEASES.

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From the public health standpoint books which have come in contact with patients suffering from the communicable or the contagious diseases are always likely to be considered factors in the spread of such diseases. Many individuals, in fact, attribute attacks of such infections as diphtheria to the handling of books previously used by individuals suffering from diphtheria, but in no instance has this relationship ever been satisfactorily demonstrated by the isolation of the diphtheria bacillus from this source. Despite this fact, current popular literature is full of references to this mode of infection. In many instances, however, as in the classical case described by Bugbee,[1] there is no satisfactory evidence that diphtheria was carried in this way. Nevertheless, the possibility that books may convey disease and the belief of the lay public in this possibility is of sufficient importance to merit an investigation of this problem along laboratory lines.

Before considering the detailed experiments it may be wise to consider the general subject of the isolation of pathogenic bacteria, such as diphtheria bacilli, from inanimate objects. Thus, Trevelyan [2] cultivated diphtheria bacilli from a handkerchief 11 weeks after it had been used by a child suffering from diphtheria. Wright and Emerson [3] cultivated virulent diphtheria bacilli from a brush used in sweeping a ward in which several diphtheria patients had been cared for. They also isolated the same organism from the dust clinging to the shoes of the nurses in charge of the same ward, and an organism, said to be the diphtheria bacillus but lacking in virulence, was found on the hair of one of these nurses. Weichardt [4] was able to isolate diphtheria bacilli from various objects handled by a patient with diphtheria, such as a neck-cloth and a bottle, and he also obtained the organism from a spot on the carpet about 0.5 m. distant from the patient. Hill [5] succeeded in isolating non-virulent diphtheria bacilli from a toy and from a handkerchief used by a patient after release from isolation. He also made a very extensive search for diphtheria bacilli on other inanimate objects, which had come in contact with patients suffering from diphtheria, without, however, any positive results. His examinations were made within a comparatively short time after the possible infection (within eight days), and the objects he examined had been very closely handled by the patient.

It is seen from this résumé that apparently, at times, the diphtheria bacillus may cling to inanimate objects after they have once become infected by the discharges of the diphtheria patient, but that the findings are of such variance as to indicate that the organisms of diphtheria do not find a nidus for development on objects of this character. It becomes a matter of importance, therefore, to determine, first, whether books that have come in contact with children suffering from infectious diseases are capable of harboring any organism with pathogenic properties. With this end in view, we have made a careful examination of some 75 books obtained from the Enoch Pratt Library in Baltimore (Branch 13), in the hopes of answering this question. These books had been in constant circulation for several years among children in whose homes sanitary conditions were decidedly unsatisfactory, and were badly soiled and torn. The books were swabbed off with sterile cotton swabs and the swabs then thoroughly shaken into sterile fluid, either broth or salt solution, which was then plated on ordinary media. The swabs were also rubbed over the surface of special media used in the isolation of the diphtheria bacillus, such as Loeffler's blood serum and Conradi and Troch's [6] telluride medium. Finally, the broth or salt solutions in which the swabs had been placed originally were

centrifugalized and the sediment was used for inoculation into animals. The results of this examination may be summarized briefly as follows: The majority of bacteria found on books belonged to the chromogenic group, corresponding to the species usually found in atmospheric air. They were in general, however, somewhat attenuated, and pronounced pigment production often did not come out until after prolonged cultivation in the laboratory. In addition to the chromogenic organisms, non-chromogenic micrococci and bacilli were not infrequent. They also can be identified as forms found in the atmosphere, such as *Micrococcus cremoides, Bacillus proteus zenkeri* and *Bact. troilii* (*Bacterium lactis longum b.*). Spore-bearing bacteria were often more abundant than the chromogens, the types found being the same as those isolated from dust and described in another place.[7] Finally, a few of the ordinary forms of hyphomycetes, chiefly the actinomycetes, were occasionally noticed, but never any of the basidomycetes. In two instances the presumptive test for the colon bacillus was positive, and this organism was found subsequently in pure culture. The findings of Winslow,[8] who has shown that the colon bacillus may be obtained from the hands of school children, are of interest in this connection, and the relative infrequency of this organism on soiled books would seem to indicate that it does not find on books the proper conditions for multiplication. Nevertheless, our positive findings are suggestive, in view of the fact that the viability of the colon bacillus is not very different from that of the typhoid bacillus. In no instance could the diphtheria bacillus be isolated from these books, either by the use of special media or of animal inoculation, although we were able to prove that some of the books in the lot examined had come from homes where children were suffering from the disease.

We then undertook the study of schoolbooks in the homes of diphtheria patients, and through the kindness of Dr. N. Gorter, Health Commissioner of Baltimore, it was possible to collect schoolbooks from 50 houses where diphtheria had existed, the diagnoses having been established clinically and culturally. Only those books were selected for examination where there was definite evidence that they had been handled by the patient during the disease. Altogether 150 books were studied, both by cultural methods and by animal inoculation, and our results were entirely negative. The belief that books assist in the dissemination of this disease, therefore, in our opinion, received no substantial support from their bacteriological examination in the laboratory.*

The attempt was next made to determine experimentally how long various well-established species of bacteria are able to survive on books, by deliberately contaminating them and taking cultures at various intervals. It had been previously shown by Billings and Peckham that they were able to recover *B. coli* from a silk thread that had been kept in a dark cupboard for 152 days. They also found that both *B. coli* and *B. typhosus*, when plated on agar plates and exposed to direct sunlight, show a decrease of 98 per cent within two hours, but no appreciable decrease after two days when exposed to diffuse daylight. In our experiments with these and other organisms the books were first sterilized with steam under pressure and then the covers and pages were thoroughly rubbed over with cotton swabs saturated with broth suspensions of the organism. The books were then placed aside and retained in various conditions, some in diffuse daylight, others in the dark at room temperature; they were also exposed to low temperatures and direct sunlight. As can be seen from the following table,

TABLE I. (*B. coli.*)

Condition.	Part of Book.	Average period of survival.
Dry, no daylight, room temp.	Int.	5 to 6 mos.
Dry, no daylight, room temp.	Ext.	3 to 4 mos.
Moist, no daylight, room temp.	Int.	5 to 6 mos.
Moist, no daylight, room temp.	Ext.	5 to 6 mos.
Dry, diffuse daylight, room temp.	Int.	4 to 5 mos.
Dry, diffuse daylight, room temp.	Ext.	1 to 2 mos.
Moist, diffuse daylight, room temp.	Int.	4 to 5 mos.
Moist, diffuse daylight, room temp.	Ext.	2 to 3 mos.
Low temperature (ice-box)	Int.	2 mos.
No daylight	Ext.	1 mo.
Direct sunlight (temp. 34° C.)	Ext.	12 to 20 hrs.

B. coli could be recovered from these books after so long a period as five or six months, when the conditions were proper for their survival. In other instances the organism apparently died out within a comparatively short period of three or four weeks. It is significant that they were rapidly destroyed by direct sunlight, the organisms not being recovered after 20 hours. In our experiments we recovered *B. coli* up to the period of 20 hours, after which time the organisms did not grow on our plates. Billings and Peckham [9] found that under the influence of direct sunlight a marked decrease of the organisms occurred within two hours. It is possible, as Billings and Peckham suggest, that direct sunlight not only destroys the micro-organisms, but also affects culture media so as to render them unsuitable for bacterial development.

The viability of the typhoid bacillus has been investigated by a number of individuals, and the opinion is usually held that this organism and *B. coli* succumb to the same deleterious influences. Thus, Besson [10] states that *B. typhosus* is killed by exposure to direct sunlight (in the month of May) within from four to eight hours. Vincent found that the typhoid bacillus, when spread on ordinary cloth and exposed to direct sunlight, was destroyed within from nine to 26 hours. J. McFarland [12] found that the typhoid bacillus would survive on linen for as long a period as 60 or 75 days, and upon buckskin for from 80 to 85 days, when both fabrics were kept under ordinary conditions. As can be seen from the following table,

* Similar procedures were made use of in regard to books that had come in contact with patients suffering from tuberculosis. The number of books examined was relatively small and the negative findings may not be considered sufficiently conclusive. Kenwood and Dove [6] carried on a large number of experiments as to risks from tuberculous infection retained in books and arrived at the following conclusion:

"There is probably no material risk involved in the reissue of books recently read by consumptives, unless the books are obviously soiled. Even then the risks are very slight."

TABLE II. (*B. typhosus.*)

Condition.	Part of Book.	Average period of survival.
Dry, no daylight, room temp.	Ext.	20 days.
Dry, no daylight, room temp.	Int.	4 to 5 mos.
Moist, no daylight, room temp.	Ext.	10 days.
Moist, no daylight, room temp.	Int.	3 to 4 mos.
Dry, diffuse daylight, room temp.	Ext.	12 days.
Dry, diffuse daylight, room temp.	Int.	3 mos.
Moist, diffuse daylight, room temp.	Ext.	10 days.
Moist, diffuse daylight, room temp.	Int.	3 to 4 mos.
Low temperature (ice-box)	Int.	2 to 3 mos.
Low temperature (ice-box)	Ext.	3 to 4 mos.
Direct sunlight (temp. 32° C.)	Ext.	12 to 20 hrs.

when this is compared with the preceding table, the colon bacillus apparently survives for a longer period of time than the typhoid bacillus, when the two organisms are placed upon books under apparently identical conditions. This may be explained by the relative resistance of *B. coli* to greater degrees of dryness and moisture than is exhibited by the typhoid bacillus. Apparently also the typhoid bacillus is more rapidly destroyed by diffuse daylight than the colon bacillus, while both organisms are destroyed in a comparatively short time by exposure to direct sunlight. Finally, it is quite evident that both *B. coli* and *B. typhosus* are able to survive for so long a time upon books kept under certain conditions, as to suggest the possibility that books may serve as vehicles of infection in typhoid fever.

In a disease so important as diphtheria it is natural to expect that the resistance of the infective organism to various conditions should have been tested with great care. Thus, we find that Hill [5] has estimated the resistance of the diphtheria bacillus to diffuse daylight and has found that the organisms survived at times for as long a period as 20 days, whereas at other times they were not alive after seven days at room temperature. Abel [12] found that the diphtheria bacilli could be recovered alive from silk threads kept at room temperature and low temperature (in the dark) for as long a period as 86 days and, what is still more important, that their virulence had not lessened during this period of time. Deycke [14] found that diphtheria bacilli dried on lime-wash, oil, paint, and glue spread on wood and cement survived for various periods from one to 18 days. Reyes [15] compared the resistance of *B. diphtheriæ*, when placed on silk paper, linen, mud and sand, subjected to diffuse daylight at times and at other times kept in the dark under varying conditions of moisture. The longest period of time during which the organisms survived at all was in mud under moist conditions, from which he isolated the organism after three months. Paper contaminated with the bacteria and kept in a dry condition in the dark showed the organism after four days only, but when kept in a moist condition showed the organism after eight days. Kept in the light in a dry condition the organism survived on paper for 36 days, but for 56 days in the moist condition. Germano [16] concluded from his experiments that diphtheria bacilli can survive for a long period of time on ordinary cloth, at once suggesting the danger that may arise when schoolbooks are provided with cloth covers. Finally, Gehrke [17] found that the diphtheria bacillus, when suspended in water, was killed by direct sunlight in from two to eight hours, while Ledoux [18] demonstrated that the organisms, when dried in thin layers, were rapidly destroyed by the same agency.

In our experiments with this organism we employed recently isolated strains of a highly virulent character, and that killed guinea-pigs weighing 250 gm. within 48 hours. As can be seen from the following table, in certain instances the organisms survived for a period of three months on books, and in these experiments the virulence of the organism remained practically undiminished. In general the exposure of the books to diffuse daylight was fairly efficient for the destruction of the organisms upon the exterior, but very much less efficient for the destruction of the bacteria inside the covers. The most favorable conditions for survival of the organisms are moisture, lack of sunlight, and room temperature.

TABLE III. (*B. diphtheriæ.*)

Conditon.	Part of Book.	Average period of survival.
Dry, no daylight, room temp.	Int.	2 to 3 mos.
Dry, no daylight, room temp.	Ext.	1 mo.
Moist, no daylight, room temp.	Int.	1 to 2 mos.
Moist, no daylight, room temp.	Ext.	22 days.
Dry, diffuse daylight, room temp.	Int.	2 to 3 mos.
Dry, diffuse daylight, room temp.	Ext.	5 days.
Moist, diffuse daylight, room temp.	Int.	1 to 2 mos.
Moist, diffuse daylight, room temp.	Ext.	1 to 2 days.
Low temperature (ice-box, no daylight)	Int.	1 mo.
Low temperature (ice-box, no daylight)	Ext.	20 days.
Direct sunlight (temp. 35° C.)	Ext.	4 to 6 hrs.

Finally, the organisms were destroyed by direct sunlight by an exposure of but four to six hours.

CONCLUSIONS.

From the experiments described in this paper, which we may say have been repeated on a number of occasions, one or two points of considerable importance come out.

1. Pathogenic bacteria can seldom be isolated from books which have been handled by sick patients, and there is, therefore, no empirical reason for maintaining that books serve as vehicles of infection.

2. Direct sunlight and diffuse daylight are the most efficient germicides for organisms found on books, as they are for the same organisms under other conditions.

3. The fact that pathogenic bacteria, like the typhoid bacillus and diphtheria bacillus, can be recovered from artificially infected books under various circumstances after long periods of time, and the fact that the diphtheria bacillus does not lose in virulence during this period, are a sufficient reason for insisting upon the thorough disinfection of books which have been handled by patients.

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PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

FEBRUARY 7, 1916.

1. Presentation of a Possible Case of Heat Cramps. R. L. HADEN.

This patient is an Austrian, 29 years old. He was admitted to the hospital on February 3, 1916, complaining of cramps. He has had no similar illness before, and his past history is unimportant. For the last three months he has worked at a copper mill, where he has been filling the furnaces in which the copper and zinc are smelted. He says that he has worked in many hot places, including the furnace room of a trans-Atlantic liner, but that this is the hottest place he has ever been in.

He has been working on the night shift. He went to work on Wednesday at 4 p. m., after eating a light dinner. At 8 p. m. he drank some coffee and after this did not eat or drink anything. About 10 p. m. he began to have diarrhœa, which gradually increased in intensity until midnight, when he was having a stool every 5 or 10 minutes. The stools were copious and watery. He does not know whether they contained blood or mucus. The diarrhœa continued, though it was less severe, until 2 a. m., when he lay down near the furnace and went to sleep. Usually he had been sleeping outside. At 3 a. m. he awoke with intense abdominal cramps, which lasted only a few moments and were followed by severe cramps in the muscles of the legs, arms, neck and face. He also says that he was unable to speak. The cramps became less severe about noon. He vomited everything swallowed. The diarrhœa ceased soon after the onset of the cramps.

On admission to the hospital at 4 p. m. he looked very ill; he lay in bed with his eyes half closed; the cheeks were sunken; the lips and finger tips were quite cyanotic. At intervals there were localized tetanic contractions of the muscles of the legs, thighs, and arms. All the muscles of the body were very tender on palpation. The head, heart, and lungs were negative. The abdomen was scaphoid, but showed no peristalsis or abnormal masses. There was diffuse tenderness which seemed to be in the abdominal wall itself. He had no stools after admission and the muscle cramps ceased soon after the administration of morphin. He had no fever. The W. B. C. were 18,000. He has rapidly recovered.

DISCUSSION.

DR. JANEWAY: It seemed worth while to present this patient, although the diagnosis is not absolutely certain, in order to call attention to a disease rare in the literature, but apparently not so rare in real life. Of course, in this particular patient, one may assume that he suffered from cholera nostras and that the muscle cramps were such as can occur in Asiatic cholera or some other choleraic diarrhœa. Against that is the fact that the diarrhœa stopped before the cramps began and that the patient did not show the extremely pinched look and the great prostration, feebleness of voice, etc., that go with cases of choleraic diarrhœa. Edsall described in 1904,[1] and subsequently in 1908,[2] a condition of extreme cramp-like contractions of all of the muscles of the body, occurring in individuals performing hard manual labor, while exposed to excessive temperature. The first two cases occurred during extremely hot weather, but the subsequent group of cases came from foundry workers exposed to the great heat of furnaces. On further study, he found that this condition was quite well known to ship's surgeons who dealt with stokers, and to some physicians in great industrial plants. With the exception of Edsall's article and a short publication by Meyers in the Virginia Medical Semi-Monthly, little has appeared about this condition. The subject is an interesting one and of considerable importance. A number of men die, as the result of these cramps, in the course of a few hours, or in a day or two. Dr. Edsall made a study of the metabolic changes, which he told me of, but I have not been able to find that he ever published his results. I am in hopes that the opportunity of seeing this patient may interest some of you who have access to patients from the big industrial plants, who are exposed to high temperatures, and that you may look out for the condition and perhaps describe it more fully, particularly with regard to what Edsall found—an enormous nitrogen output in the urine, with apparently complete retention of chlorides. Edsall was inclined to regard the condition as the immediate effect upon the muscle of the high temperature and the cramps as resulting directly from actual changes within the muscle substance. The similarity of the cramps to those of choleraic diarrhœa would bring up the question whether desiccation from excessive perspiration may play a part. In this particular patient, I am inclined to think that the diarrhœa predisposed him to the development of heat cramps, though one may believe that he had merely an extremely severe type of muscle cramps in connection with a short attack of cholera nostras. The patient had no rise of temperature.

[1] Edsall, D. L.: Two cases of Violent but Transitory Myokymia and Myotonia, apparently due to excessive hot weather. Am. Jour. Med. Sci., 1904, n. s., CXXVIII, 1003-1011.

[2] A Disorder due to Exposure to Intense Heat. J. A. M. A., 1908, LI, 1969.

2. **The Diagnosis and Treatment of Umbilical Concretions, with Report of a Case.** DR. S. V. IRWIN.

Abscesses of the umbilicus are not common and, of those that are met with, the larger percentage are due to concretions. In over 108,000 admissions to The Johns Hopkins Hospital, in all services, only three cases of abscess of the umbilicus have been observed. Two of these were certainly due to concretions, and although there may be some doubt about the third case, after having made a careful analysis of the history, I have been led to believe that in this also the abscess was due to a concretion.

The case which I am presenting to you this evening is that of an unmarried girl, about 18 years of age, who entered the hospital January 6, 1916, complaining of a very painful, indurated and tender umbilicus which had been discharging pus for nine weeks.

Family History.—Unimportant.

Previous History.—Her general health was always good until an attack of measles five years previously—since which time she has suffered with frequent headaches and weakness. During the last nine months she has had attacks of fainting, often preceded by vertigo. She had slight attacks of otitis media six months ago. She has had occasional slight attacks of palpitation of the heart and œdema of the ankles. Her appetite has been poor during the last six months. During this time she has had a few attacks of very slight hematemesis—also occasional attacks of pain in the right lower abdominal quadrant. She gives a rather uncertain history of tarry stools. She has had a tendency to constipation.

She has had various slight attacks of cystitis that always cleared up rapidly under treatment. One year ago she had an attack of metrorrhagia, which persisted for eight months, until a curettage was done; since this time menstruation has been regular. She has lost about 25 pounds in weight during the last three months.

Present Illness.—On August 15, 1915, five months before admission, the patient was seized with a sudden severe pain in the right lower abdominal quadrant, followed by nausea and vomiting. On the next day a burning sensation was felt just to the left of the umbilicus, followed two days later by a slight swelling in this region, which grew larger and more painful until it reached the size of a hen's egg. The mass was fluctuant and surrounded by a ring of induration, but without any noticeable reddening. On October 23, the mass ruptured and a bloody, foul-smelling, purulent material was discharged from the umbilicus. After this the pain was somewhat lessened, but the bloody material continued to discharge for about three weeks. It then ceased for a week, but the tissues around the umbilicus became indurated, tender, and reddened; the swelling became so great that the umbilicus was almost obliterated. Finally, a sero-purulent material, which soon became thick, creamy, and greenish in character, began to discharge from the now obscured umbilicus, and the pain changed from that of a sharp stabbing character to one of a burning stinging nature.

The *physical examination* was practically negative, except for the abdomen. At the umbilicus there was an ulcerated area, about 5 cm. in diameter, crusty, reddish-yellow, scab-like in character, which was immediately surrounded by an indurated area extending 3 cm. outside of the scaly zone. The abdomen was everywhere extremely sensitive, the lightest palpation causing the patient to cringe with pain. This was more marked as one approached the umbilicus. There was no muscle spasm. The leucocytes were 8,440; the hæmoglobin was 83%. The pus from umbilicus showed many cocci which were gram-negative. The urine was normal. The pus on repeated examinations gave a negative guaiac test. Dr. Thomas S. Cullen diagnosed the case as one of umbilical concretion.

Umbilical concretions are found most often in people of middle age; rarely in children or the aged. People of unclean habits are most frequently affected, particularly the men, probably due to the fact that they lead a more active life.

The first symptom noticed is an attack of severe pain, usually referred to the umbilical region. Nothing is seen for from one to three days later, when a swelling, which is often surrounded by a reddened zone, appears at or near the umbilicus. The pain continues, being intensified by anything which causes the slightest tension on the abdominal muscles. Induration, usually accompanied by a reddening of the overlying skin, spreads through the tissues in the immediate neighborhood of the umbilicus, causing it to assume the appearance of a fistulous opening and to become exquisitely tender and painful. The induration increases and is usually uniform, but at times an elevation, varying in size from a pea to a hen's egg, may be produced, which later may become soft and fluctuant at its center. The patient suddenly experiences in the umbilicus an excruciating pain, which is followed almost immediately by a gush of bloody, purulent, often foul-smelling material, after which the pain markedly diminishes. The discharge in a few days changes to a serous character and later becomes thick and creamy-yellow, disappearing entirely in a short while if the foreign body has been extruded with the flow of pus; otherwise it continues until the obstruction is removed.

Most of the concretions are composed of a sebaceous material, which is exceedingly friable. They often contain hairs, bits of wool or cotton fibers, or even particles of stone, coal or wood, depending on the person's occupation. Besides these, there are concretions which have a pearly appearance and are firm, smooth, and laminated, varying in size from a pea to that of a large marble.

The factors of greatest etiological importance in the causation of umbilical concretions are:

1. Lack of personal cleanliness.
2. An unusually deep umbilicus.

Foreign particles, sweat or sebaceous material collecting in the umbilical depression may form a small ball, which by its constant irritation causes an exfoliation of the squamous epithelium lining the umbilicus. The resulting mass renders the neighboring subcutaneous fat or the properitoneal tissues susceptible to infection, with the consequent thickening and hardening of these tissues and narrowing of the umbilical opening until it becomes little larger than a fistulous aperture. Pus accumulates and dilates the depression, which finally becomes closed off and there is formed a large tense pus sac that presses on the neighboring, intensely inflamed tissue, producing an increase in the already severe pain and tenderness.

If the cavity of the umbilicus be dilated, it is usually found greatly distended, filled with pus, and containing a concretion of a solid or friable material. This cavity may be several centimeters in diameter; or sometimes two cavities may be found, the one, containing the pus, being connected by a short, narrow, fistulous tract with another smaller one, in which lies the concretion. Thorough exploration is, therefore, always necessary, as pus will continue to form as long as the foreign material remains.

The *diagnosis* of umbilical concretions is not always an easy task, since any condition which produces induration, swelling and tenderness, or a discharge of purulent material through the umbilicus, necessitates a consideration of all the various diseases which can produce such signs in this region.

Quite a number of cases of dermoid cyst of the umbilicus are on record. The majority of these, however, have not been dermoids, but have been abscesses due to an accumulation of cheesy material and hair in the umbilical depression.

Sub-umbilical abscesses occasionally occur. It has been found that, just below the umbilicus, there exists a space bounded in front by the recti muscles, and behind by the peritoneum; and, as

one passes backward from the linea alba, one will often find a partition, which divides the triangular sub-umbilical space into two cavities. This sub-umbilical space is occasionally the seat of an abscess.

Now and then urachal remains become infected, giving rise to an abscess between the umbilicus and symphysis. These infections are usually of a low grade; they occasionally give rise to an escape of pus from the umbilicus.

3. Medical Aspects of the European War. (Abstract.) DR. A. M. FAUNTLEROY, U. S. N.

Dr. Fauntleroy gave a very interesting account of the methods used in France in the care of the wounded. He showed a number of lantern slides, illustrating the first aid stations, where the tetanus and antitoxin vaccines are administered, the field hospitals and the base hospitals. Another group of pictures showed the use made of railway stations as first aid hospitals, before the wounded are transported to the base hospitals.

In an interesting series of pictures he showed the types of military ambulances in use; also the motor field hospital, which consists of several machines carrying x-ray and sterilizing equipment, and materials for a portable operating room. Apparently, this form of hospital has been used with much success.

Some time was devoted to a consideration of the splendid work done at the American Ambulance in Paris, from the clinical and also from the laboratory side. The results of treatment seemed to be remarkably good. A good deal of the apparatus used for the orthopedic cases was specially devised and made in the orthopedic workshop of the American Ambulance, and met the needs most successfully.

Dr. Fauntleroy did not go into detail with regard to the treatment of infected wounds, calling on Dr. Kenneth Taylor to present this aspect of the work.

4. Wound Infection and Treatment. (Abstract.) DR. KENNETH TAYLOR.

I would like to emphasize the points that the wounds are heavily infected and are infected by three distinct organisms, which are the cause of most of the deaths from infection as we see them in the hospitals. First, the tetanus bacillus, which has been practically eliminated, so far as the French army is concerned, by the systematic use of antitoxin, which, as Dr. Fauntleroy has said, is usually given at the first aid station, and, if not there, at the first hospital the patient comes to. Second, the streptococcus is still one of the agents that kills most of the men from wound infection. The third, and perhaps the one you are most interested in here, first described by Dr. Welch, is *B. aërogenes capsulatus*, which has become one of the most active factors. It occurs in from 70-80 per cent of the fresh wounds, and persists for varying periods of time, sometimes as long as 100 days after the injury, in chronic sinuses. By gas gangrene, we mean the death of greater or lesser extents of muscle tissue, due, we think, to local infection and the local elaboration of gas and some toxic principle by this bacillus.

The condition is associated with a swelling involving the muscles opening into the wound, a heavy, sweetish odor, the presence of gas either beneath the skin or bubbling from the wound, discoloration and œdema of the skin and subcutaneous emphysema with or without blebs. Nearly 70 per cent of our fresh wounds showed this organism. Indeed it has been found to be so common that we have come to regard our fresh wounds as cases of potential gas gangrene. It is the one thing every surgeon is on the lookout for in the early stages of the wounds. It occurs rapidly. A fairly innocent wound will assume large proportions, distension will occur, and the whole course may be very rapid.

In regard to the incidence of the organism, we found in one series of cases, in wounds which were ten or more days old, an incidence of 65 per cent. In another series there was an incidence of 70 per cent. In about 28 per cent of these, or slightly more than one-fourth, the diagnosis of gas gangrene was made independently of the laboratory. All the symptoms were present. At the American Ambulance gas gangrene has furnished slightly over 10 per cent of the fatal cases during the year I was at the hospital. A great many other cases have resulted in the loss of a limb, and in many instances it has undoubtedly been an accessory factor.

After watching the cases in the hospital, examining the specimens from the mortuary and the cadaver, together with more or less extensive animal experiments, we have considered that the more severe or fatal cases pass through certain definite stages. We have the *treatment stage*, which represents the stage in which there is local infection of the wound, with perhaps gas bubbles and smears showing the gas bacillus. Then we recognize the *stage of gas distension*, which we think is the result of some obstruction to the escape of the gas. The organism shows a preference for muscle tissue, and dead muscle is its favorite food. This obstruction causes a condition of gas distension. During this stage may be seen the swelling, subcutaneous œdema and the discoloration of the skin, the œdema perhaps being due to the intermuscular pressure, which is due to the distension by gas and the obstruction not only of the myelin, but also the vascular, circulation of the muscles. The third stage is the *explosive stage*, characterized by the rapid swelling of the muscles, associated with subcutaneous crepitus. The subcutaneous gas is probably the result of the rupture of muscle sheaths, and the rapid expansion of the gas probably aids in the dissemination of the bacillus, as the distribution of the gas is in direct relationship with the distribution of the bacilli or the extent of the infection. By experimenting on guinea-pigs, we have found that we can inject the thighs of a series of animals, kill them at intervals, and after a period of from 3 to 4 hours find a complete gas distension of a group of muscles; and yet, when the whole leg is dissected, we find that the bacteria are still limited practically to the point of implantation.

Following the rapid expansion of gas in the explosive stage, comes the *stage of systemic infection*, during which the individual is poisoned probably by two factors—a toxin or a toxic principle formed by the organism, and toxic by-products. The state of septicæmia is probably very rare, and is probably also a terminal condition.

I have seen one case in which the organism was recovered from the blood.

The first stage of local infection in the wound, with the free escape of gas, represents the common type, and most cases do not pass beyond this stage. When the free escape becomes interfered with, the stage of gas distension develops rapidly and passes, frequently within a few hours, into the third stage. The progress is tremendously rapid. I have seen men who wished to get up out of bed dead six hours later from gas gangrene.

Another special point is that the stage of gas distension may not be recognized, as it need not be painful. I suppose that a sort of pressure anesthesia is present. Often very sudden collapse occurs, which is evidently due to an acute toxæmia. If drainage sufficient for the escape of gas be established, recovery is usual. The possibility of gas embolism cannot be excluded. It is probably the principal cause of death.

This analysis has been based upon several observations. We have looked into the question of toxic principles formed by the organism, and found no active endotoxin. The toxic principle in 48-hour broths in which the bacteria have grown, but only in large doses, will kill guinea-pigs with symptoms closely resembling those of an active infection. The other factor is the gas. We have satisfied ourselves that this is not toxic. We have been able to remove the carbon dioxide, which forms about 40 per cent of it.

and have injected subcutaneously into the peritoneum of guinea-pigs large amounts of the remaining gas. While it is possible to blow a small guinea-pig up to the size of a toy balloon, the animal suffers little discomfort and there are no toxic symptoms.

The mechanical action is one of the chief factors in the infection. You can attach an indicator from a steam sterilizer, for instance, to a test tube of a medium inoculated with bacteria, and can run up a pressure of an atmosphere and a half in a few hours. The picture in the muscle reminds one of the same condition.

One of the chief problems in treatment has become that of establishing drainage for the escape of gas rather than for the escape of pus. This is a very difficult problem, as the gas extends by the process of muscle distension and infiltration. For the local treatment we have been using a quinine solution, a procedure which was based on experimental evidence and which has worked out fairly well clinically. In experimenting with a good many antiseptics, we found that quinine seemed to be most active, and especially hydrochinon. Carbolic acid is a poor antiseptic against the anaërobes and especially against the gas bacillus. In a favorable medium, the gas bacillus will grow in the presence of nearly 2.5 per cent of carbolic acid. Laboratory experiments have shown that we have been able to rid of gas bacillus wounds much earlier by the use of quinine than of the other antiseptics tried.

DISCUSSION.

DR. WELCH: It is very interesting to hear from both Dr. Fauntleroy and Dr. Taylor of the elimination of tetanus. This is one of the great triumphs of preventive medicine. The control of typhoid fever by vaccination is another great triumph. I understood Dr. Fauntleroy to say that the vaccine used in the French army is one that produces a severe reaction, but is very effective in the control of typhoid fever. I understand that this is not used for the para-typhoid fevers.

I have been much interested in Dr. Taylor's studies of the gas bacillus, which was first observed here and which has turned out to be of such importance in surgery. There has been a laboratory study of the organism from Dr. Rosenau's laboratory in Boston, made by Dr. Simmons. He has discussed a great many of the questions relating to the character of the organism. He takes the position that there are variations, and that possibly a group of these organisms exists. Of course we recognized here that this is one of the most widely distributed of pathogenic bacteria, appearing everywhere in soil and in the intestinal contents, not only in human beings but in most domestic animals. It is, therefore, not surprising to hear from Dr. Taylor that the organism is found in 71 per cent of the wounds examined bacteriologically. It is evident that fighting in the trenches brought about possibilities of contamination of the wound with soil that have never appeared before.

Experiments and observations have shown that the mere presence of the gas bacillus or the tetanus bacillus in the wound does not constitute infection, but that a variety of circumstances are necessary to cause this. What these are, we do not know altogether, but there must be favoring circumstances, for the presence of the bacteria, although essential to infection, does not insure infection.

This discovery of the value of the treatment of these wounds with quinine solutions is certainly a very valuable contribution. It is certainly interesting and rather surprising that this drug should turn out to be so valuable a bactericidal for this particular organism.

FEBRUARY 21, 1916.

1. Nerve Conduction in the Non-Medullated Nerves of Medusa Cassiopea. (Abstract.) By ALFRED GOLDSBOROUGH MAYER.

If a pulsation wave be started in *one* direction in any circuit-shaped strip of tissue, it cannot escape from the circuit, but must continue to move forward until stopped by a wave going in the other direction, blocked by a break in the circuit, or exhausted by fatigue. Such waves may continue for more than a week in ring-shaped strips of the sub-umbrella tissue of *Cassiopea*. The stimulus which produces this contraction is neurogenic, and, if external conditions such as salinity, temperature, CO_2, and H-ion concentration, remain constant, its rate also remains practically constant. If, however, we dilute the sea water with distilled water, 0.9 molecular dextrose, or 0.4 molecular magnesium chloride, the rate declines. The formula for the decline when these solutions contain the same concentration of H- and OH-ions as the sea water is

$$y = 2.512\, x^{0.8}$$

where y is the rate of nerve-conduction, and x is the concentration of the cations of sodium, calcium, and potassium in the surrounding sea water.

This formula resembles Freundlich's expression for chemical adsorption, and suggests that the sodium, calcium, and potassium cations that take part in nerve conduction are adsorbed, being attracted to the surfaces of the negatively charged colloidal particles of the nerve. Thus, being a chemical reaction, nerve-conduction must, by Wilhelmy's law, progress at a rate proportional to the concentration of the adsorbed sodium, calcium, and potassium cations which conduct it. Also, when these cations combine to form an ion-proteid, they leave unbalanced the negative charges upon the colloidal particles, and this negative potential must travel through the nerve at the rate of nerve-conduction.

Moreover, if two equal nerve impulses traveling in opposite directions meet, they annul one another, for each has exhausted the supply of adsorbed cations, and it takes time for the colloidal particles to attract other cations to their surfaces.

In these simple non-medullated nerves a strong stimulus consumes more of the adsorbed cations than a weak one and thus travels at a proportionately faster rate. Moreover, as it takes time for the colloidal particles to recapture and adsorb new cations, the resting interval for the nerve must be longer for strong than for weak stimuli. Hence, a very strong stimulus can follow a very weak one without any resting interval, for it can still act upon adsorbed cations which the weaker stimulus has not neutralized. The sea water, or the fluids bathing the nerves, are normally alkaline, and thus the OH-ion is in excess. This OH-ion is not adsorbed, but acts as a catalyzer. If we heat the nerve, we would expect its rate to augment from two- to three-fold for every ten degrees, were its activity due solely to the OH-ion; but heat dissociates the adsorbed Na, Ca, and K and thus the resultant rate is reduced, augmenting only in a linear ratio.

This hypothesis does not attempt to explain the nature of the chemical reaction between the adsorbed cations and other elements to form an ion-proteid, but claims that nerve conduction is accompanied by a chemical reaction between the *adsorbed* sodium, calcium, and potassium cations and some undetermined elements of the protoplasm.

Fuller details of this research will be found in The Proceedings of the National Academy of Sciences (1916, January, Vol. 2, pp. 37-42), and a much more complete paper in the American Journal of Physiology (1916, February, Vol. 39, pp. 375-391).

2. A System for Following Postoperative Patients. DR. FREDERICK W. BANCROFT, New York City.

To appear later in the BULLETIN.

3. Thorium: A New Agent for Pyelography. DR. J. EDWARD BURNS.

To appear later in the BULLETIN.

THE JOHNS HOPKINS HOSPITAL HISTORICAL CLUB.

FEBRUARY 14, 1916.

1. **Medicine in Japan and China.** Dr. William H. Welch.

To be published later in the Bulletin.

THE LAENNEC.

FEBRUARY 28, 1916.

1. **Tuberculosis in Early Childhood.** (Abstract.) Dr. Alma Rothholtz.

Dr. Rothholtz made a preliminary report on work done in the Harriet Lane Home on tuberculosis in early childhood and presented the following statistics as the result of her study:

Number of hospital outpatients in Harriet Lane Home	9,380
Total number of tuberculous patients	435
Total number of tuberculous patients under 3 yrs.	123

AGE.

Under 6 months	10 (died, 6)
Under 1 year	28 (died, 15)
Under 2 years	56 (died, 21)
Under 3 years	29 (died, 6)

COLOR.

White	62
Black	61

VON PIRQUET.

Positive	110
Negative	6
Not read	7

EXPOSURE.

Positive	50
Doubtful	13
Negative	39

SYMPTOMS.

Cough	53
Fever	88
Loss of weight	36
Intestinal	22
Convulsions	21

PHYSICAL SIGNS.

Lungs	94
R. U.	34
L. U.	42
R. B.	5
L. B.	11
Râles	65
Effusion	2
Peritoneum	4
Enlarged spleen	48
Tuberculous glands	44
Tuberculous bones	11
Hip	3
Phalanges	3
Spine	3
Ankle	1
Ribs	1
Meninges	23
Skin	19

X-RAY.

Positive	64
Negative	3
Not done	56

CAUSES OF DEATH.

	Ac. gen. miliary tuberculosis.	Pulmonary tuberculosis.
Under 1 year	13	8
Under 2 years	13	8
Under 3 years	3	2

DISCUSSION.

Dr. Hamman: Dr. Rothholtz's remarks touch upon some of the vital questions of the anti-tuberculosis campaign. A great deal already has been accomplished in the fight against tuberculosis, but we must admit that our success falls short of what was promised and confidently anticipated. The value of the methods so far used in the campaign was unwittingly exaggerated. From a broad sociological standpoint the treatment of tuberculosis has failed. Home prophylaxis has been no more successful: nurses have shown the futility of this remedy. We have come, as it were, to a halting place, where we must rest and carefully review our work and rearrange plans for the future. It is by no means clear which road we should travel from now on. The growing importance of infection in early childhood has led many to look to this aspect of the question as the one holding the greatest promise for the future.

Not many years ago the transmission and development of tuberculous infection were regarded as settled and simple problems. It was thought that contact with the tuberculous led to infection, and that infection was promptly followed by disease. It was a remarkable insight that led von Behring to break from this general view and place the period of infection in early childhood. Later studies, particularly the observations upon tuberculin hypersensitiveness, have fully confirmed his contention. We now know that nearly all children are infected before they reach the twelfth year.

Another important conclusion that has come from immunological studies upon tuberculosis is the power of infection to protect against reinfection, or perhaps better termed superinfection. The usual form of pulmonary tuberculosis in adults, chronic ulcerative phthisis, is the expression of a high degree of resistance to the disease. How very different are the clinical manifestations of tuberculous disease in adults and the clinical picture Dr. Rothholtz has drawn from her observations upon children.

The difficult problem we face at the present time is to learn how to use this knowledge to practical advantage. On the one hand, if we solicitously guard children against infection an unprotected population will grow up which we are led to infer would rapidly succumb to tuberculosis were it exposed to infection. On the other hand, although we believe that infection successfully overcome is a strong barrier to the development of tuberculous disease, still we have no way of applying this knowledge for prevention. Surely no one would advocate the purposeful exposure of children to infection; and yet to guard them too closely may just as certainly defeat our purpose.

On the basis of what we have learned concerning childhood infection many are inclined to deny all importance to adult infection. In my opinion this extreme is unjustified. While previous infection may protect against occasional and mild reinfection, the barrier breaks down before repeated and massive implantations.

Therefore, to find our way in the anti-tuberculosis campaign we need a better insight into the many details of childhood infection. Such careful studies as Dr. Rothholtz has made will gradually clear our vision.

Dr. Ford: The points brought out by Dr. Hamman are particularly interesting. We have not made the impression on tuberculosis that we should have made, and some of us are inclined to believe that one of the reasons is that we have gone on and carried out certain precautions which we all suspected were not effective, such as the disinfection of a house after tuberculosis. I,

personally, am beginning to think that disinfection carried out by municipal authorities might just as well not be done. You cannot disinfect a house by the methods applied, unless you are willing to devote a very considerable time to it, spend a good deal of money and put an expert in charge of the work. In the majority of cases, disinfection is of doubtful value and is apt to give a false sense of security. That is the opinion of Dr. Dunbar of Hamburg, and has been for a number of years, as the result of his investigations. He has given up gaseous disinfection and substituted for it the washing of the floors and walls up to the height of six feet with soap and water and a strong disinfecting solution. I think he feels that this is an advance. It does not lull the people to sleep, but impresses upon them the necessity of cleanliness. It is also the opinion of Dr. Chapin, one of our best authorities, that many of the measures carried out to control contagious diseases have had little effect upon them and that the time has come when substantial changes should be made in our method of combating them.

DR. PARK: Some of the points brought out by Dr. Rothholz this evening are very striking to anyone who has worked in the Harriet Lane Dispensary. The first and one of the most important is the liability of a young child exposed to tuberculosis to contract the disease. When we find that a mother or father has active tuberculosis, it is probable that the infant has tuberculosis also. When one member of a family of children is infected, usually all the other members of the family are also affected.

Another important point brought out by Dr. Rothholz is that children infected with tuberculosis in their first year do not necessarily die. It is commonly thought that all children infected with tuberculosis in the first year die, but Dr. Rothholz has found several instances of children infected in their first year who are still living and are to all appearances in good health.

Another interesting observation which she has made is that infants showing papulo-necrotic tuberculides do not necessarily die. It is ordinarily taught that children showing this lesion, which implies that tubercule bacilli have entered the blood stream, die within two or three months.

It is most important to appreciate the clinical differences in the manifestations of tuberculosis in infants and in adults. How often an infant with a disseminated infection appears to be in blooming health, with red cheeks, splendid nutrition and gains steadily in weight! When infants with pulmonary tuberculosis are auscultated, it is very common to find that no râles or definite changes in the breath sounds are present. The earliest and most constant physical sign present in infants with pulmonary tuberculosis is impairment in the percussion resonance, usually over rather large areas.

It is interesting to note that Dr. Rothholz's statistics show enlargement of the spleen to be present in 50 per cent of the cases. Enlargement of the spleen in very young infants means usually either syphilis or tuberculosis.

2. Carcinoma of Pleura. DR. STANHOPE BAYNE-JONES.

To appear later in the BULLETIN.

3. Choroidal Tubercles in General Miliary Tuberculosis. DR. R. L. RANDOLPH and DR. H. C. SCHMEISSER.

BOOKS RECEIVED.

Oxford Medical Publications. Henry Frowde, London; Hodder & Stoughton, London.

1. *Manual of Surgery.* By Alexis Thomson, F. R. C. S. Ed., and Alexander Miles, F. R. C. S. Ed. Volume first. General Surgery. Fifth edition, revised and enlarged, with 289 illustrations. 1915. 12°. 801 pages.

2. *Manual of Surgery.* By Alexis Thomson, F. R. C. S. Ed., and Alexander Miles, F. R. C. S. Ed. Volume second. Regional Surgery. Fifth edition, revised and enlarged with 301 illustrations. 1915. 12°. 948 pages.

3. *Practical Prescribing and Treatment in the Diseases of Infants and Children.* By D. M. Macdonald, M. D., F. R. C. P. E. 1915. 16°. 199 pages.

4. *Cerebro-Spinal Fever.* By Thomas J. Horder, M. D. With seventeen illustrations. 1915. 16°. 179 pages.

Oxford War Primers. Henry Frowde, London; Hodder & Stoughton, London.

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